THE PHILIPPINE
JOURNAL OF SCIENCE

VOL. 61 SEPTEMBER, 1936 No. 1

SOIL TYPES AND GROWTH OF ALGÆ IN BAÑGOS FISHPONDS

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In the Philippines the commonest edible fish is the bañgos (*Chanos chanos* Forskål). The cultivation of this fish in ponds has been developed extensively, especially around Manila Bay.

Bañgos are essentially vegetarians. Their food consists principally of various species of algæ, known locally as *lumut*. When the supply of lumut is abundant the fish thrive and grow rapidly. Although hydrophytic in character these plants get part of their subsistence and anchorage from the soil.

This paper gives the results of a preliminary investigation to determine the types of soil found in some bañgos ponds and to ascertain their relation to the growth of the algæ.

HORIZONS OF FISHPOND SOILS

Soils that have water as the principal gross component were designated by Veatch as hydrosols. He classified such soils into four major morphologic horizons; namely, aqueous, subaqueous, and basal horizons in addition to the subbasal geologic substratum.

The hydrosols of the bañgos ponds around Manila Bay belong, in general, to the lacustrine group of shallow saline aqueous horizons. The depth of the aqueous horizon ranges from 20 centimeters in Cavite Province to 110 centimeters in Pampanga.

Aqueous horizon.—The first major horizon consists of the surface water, which is the "A_0" horizon of the normal soil

profile. Its importance lies in the fundamental requirements of many aquatic plants, which live almost entirely in a medium of water. Salinity, hardness, solids in suspension, and depth of the water are the most important factors in this zone.

Subaqueous horizon.—The second major horizon, the mud portion, is the "A" horizon in the normal soil profile. This is the anchorage place for most of the aquatic plants and a source of their nutrients. The physical properties and chemical composition of the soil in this zone naturally affect the growth of the plants.

Basal horizon.—The third major horizon is the "B" horizon in the normal soil profile. This is not as important as the subaqueous horizon. However, when the first and second horizons are shallow, its importance becomes quite significant.

Subbasal geologic substratum.—This is the "C" horizon in the normal soil profile. The character of the basal horizon is more or less dependent upon the geologic formation of this subbasal horizon.

SOIL TYPES OF SUBAQUEOUS HORIZONS

Field observations and the collection of soil samples of subaqueous horizons were made in four provinces bordering on Manila Bay; namely, Bataan, Pampanga, Rizal, and Cavite. All the samples were obtained from representative bañgos ponds by means of a post-hole digger. The growth of algæ, where the samples were taken, was carefully noted.

There were 6 samples collected from Bataan, 11 from Pampanga, 4 from Bulacan, 8 from Rizal, and 4 from Cavite, making a total of 33 soil samples. The number and location of the samples are recorded in Table 1. The description and relative growth of algæ are given in Table 2.

Soil samples of the subaqueous horizons of the different fishponds were classified according to definite soil types as follows:

Type 1.—Peaty clay either compact or matted in structure. Samples 11, 16, 17, 18, and 25.

Type 2.—Peaty clay either soft or fluid in consistency. Sample 23.

Type 3.—Slimy clay, slightly organic and gelatinous in consistency. Samples 9, 13, 14, 19, 21, and 33.

Type 4.—Clay-colloid, largely inorganic, containing either dark-colored, grayish green, or reddish mud. Samples 10, 15, 26, 27, 36, and 40.

TABLE 1.—*Location of soil samples of the subaqueous horizon.*

Sample No.	Place.	Pond No.	Remarks.
1	Sibacan, Balanga, Bataan	1	
3	do	2	
4	do	1	
6	do	3	
7	do	4	
8	Puerto Rivas, Balanga, Bataan		Near the sea.
9	Guagua, Pampanga	1	
10	do	1	
11	Sexmoan, Pampanga	1	
13	Betis, Pampanga	1	
14	do	1	
15	do	1	
16	Hacienda San Esteban, Macabebe, Pampanga	10	
17	do	10	
18	do	14	
19	do	3	
21	do		Lot 1–A.
23	Hacienda Sapang Cauayan, Hagonoy, Bulacan		Lot 3–A.
25	do		Lot 4–A.
26	do		Lot 2–A.
27	Bambang, Bulacan, Bulacan	1	
29	Caloocan, Rizal	4	
30	do	3	
31	do	5	
32	Longos, Malabon, Rizal	1	
33	Parañaque, Rizal	1	
34	do	1	
35	Las Piñas, Rizal	1	
36	do	1	
37	Bacoor, Cavite	1	
38	Dalahican, Noveleta, Cavite		By the sea.
40	do		Do.
42	do		Roadside.

Type 5.—Fine sandy mud, sand-organic matter admixed. Samples 4, 6, 7, 32, 35, 38, and 42.

Type 6.—Sandy mud, sand-shell admixed. Samples 1, 3, 8, 29, 30, 31, and 37.

Type 7.—Sand, clean sand compact. Sample 34.

There is a wide range of texture and consistency in the subaqueous horizons of the different fishponds around Manila Bay. Fishponds in Pampanga and Bulacan Provinces, along Pampanga and Guagua Rivers, have subaqueous horizons of fine texture consisting mostly of clay with decayed trunks, leaves, and roots of the nipa palm. This is particularly true of the ponds at the Hacienda San Esteban of the Ayala Company and the Hacienda Sapang Cauayan of the La Tondeña Company, which are in a nipa-palm region.

TABLE 2.—*Descriptions of samples of bañgos-pond soils and the growth of the algæ where the samples were collected.*

Sample No.	Depth of aqueous horizon.	Depth of subaqueous horizon.	Description of subaqueous horizon.	Description of basal horizon.	Growth of algæ.
	cm.	*cm.*			
1	0– 50	50– 82	Brown and nearly black; very fine sandy mud, largely inorganic	Dark gray sand	Few.
3	0– 60	60– 88	Very dark brown; very fine sandy mud, largely inorganic	Dark gray muddy sand	Do.
4	0– 60	60– 88	Black; very fine sandy peat, mud; with few remains of nipa palm	Dark muddy sand	Abundant.
6	0– 60	60–102	Very dark gray; very fine sandy mud; largely inorganic	Black sand	Do.
7	0– 52	52–122	Dark gray; very fine sandy mud; largely inorganic	Dark gray muddy sand	Do
8	0– 48	48– 84	Dark brown to black; peaty mud with partially decomposed nipa palm; largely inorganic.	Dark brown sandy mud	Few.
9	0– 64	64–102	Black; muddy clay; largely inorganic with marine shells	Very dark brown to black clay soil	Very abundant.
10	0– 40	40– 74	Very dark brown to black muddy silty clay with marine shells	Dark brown muddy clay	Abundant.
11	0– 46	46– 88	Dark brown to nearly black; peaty and muddy clay; partially decomposed nipa palm.	Dark gray silty clay mud	Very abundant.
13	0– 38	38– 80	Gray to dark gray slimy muddy clay	Dark gray muddy clay	Do.
14	0– 45	45– 81	Black with gray muddy clay; largely inorganic	Gray muddy clay	Do.
15	0– 70	70–102	Dark brown to dark gray muddy clay soil; largely inorganic	Dark gray muddy clay	Abundant.
16	0–110	110–150	Dark gray peaty mud; mostly of decomposed nipa palm	Reddish brown peaty mud; largely of nipa leaves.	Very abundant.
17	0– 65	65–120	Reddish brown peaty and muddy clay loam with decomposed nipa palm.	Reddish brown peaty muddy clay	Do.
18	0– 35	35–100	Dark brown to reddish brown peaty mud with marine shells and decayed roots and leaves of nipa palm.	Reddish brown peaty mud; largely decayed roots and leaves.	Do.
19	0– 55	55–105	Black slimy and muddy clay largely organic with marine shells compact.	Dark gray silty mud with decayed leaves and roots of nipa palm.	Do.
21	0– 70	70– 90	Black and gray slimy muddy clay; largely organic with marine shells compact.	Reddish brown peaty mud largely organic; decayed roots and leaves.	Do.
23	0– 60	60–105	Black peaty mud; largely of decayed remains of nipa palm	Mixture of gray and reddish brown peat mud with decayed remains of nipa palm.	Abundant.
25	0– 70	70– 90	Reddish brown slimy muddy clay with decayed remains of nipa palm.	Reddish brown peaty mud largely of decayed nipa-palm remains.	Very abundant.
26	0– 40	40– 85	Black slimy mud with plenty of marine shells	Brown mud largely inorganic	Abundant.

27	0– 25	25– 57	Very dark brown and black muddy clay; largely inorganic	Dark brown clay largely inorganic	Do.
29	0– 55	55–100	Very dark brown to black; very fine sandy mud with marine shells	Brown sandy mud with few marine shells	Few.
30	0– 50	50– 92	Dark gray to black; very fine sandy mud, largely inorganic with marine shells.	Pale brown clay mud	Do.
31	0– 43	43– 98	Dark gray very fine sandy mud with marine shells	Dark brown muddy sand	Do.
32	0– 48	48– 76	Dark gray to dark green sandy mud; compact	Gray muddy sand	Do.
33	0– 42	42–104	Black slimy muddy clay; largely inorganic; compact	Dark brown sandy mud	Very abundant.
34	0– 35	35– 65	Dark gray muddy sand with marine shells	Dark brown sand with marine shells	Very few.
35	0– 45	45– 71	Very dark gray mud; largely inorganic	Dark brown muddy sand	Few.
36	0– 35	35– 72	Very dark gray to nearly black slimy muddy clay	Gray muddy clay	Abundant.
37	0– 45	45– 85	Black slimy sandy mud; largely inorganic	Dark brown muddy sand	Few.
38	0– 40	40–112	Very dark gray to nearly black; very fine slimy sandy muddy clay loam, compact.	Dark gray mud	Abundant.
40	0– 40	40– 99	Black; very fine slimy muddy clay; largely inorganic	Dark gray peaty mud	Do.
42	0– 20	20– 32	Black slimy sandy mud, compact	Dark gray to black sand	Do.

TABLE 3.—*Average mechanical analyses of different types of subaqueous horizon and the growth of algæ.*

Type of subaqueous horizon.	Coarse sand, 2 to 0.22 mm.	Medium sand, 0.22 to 0.14 mm.	Fine sand, 0.14 to 0.07 mm.	Very fine sand, 0.07 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 mm.	Solution loss. [a]	Growth of algæ.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	
1	0.7	7.1	4.4	7.4	17.4	36.6	26.4	Very abundant.
2	0.0	0.1	0.2	10.6	33.9	33.0	22.2	Abundant.
3	2.9	6.6	6.1	11.4	20.5	35.9	16.6	Very abundant.
4	6.3	4.0	2.6	7.7	20.6	47.6	11.2	Abundant.
5	23.5	9.0	8.5	14.7	12.2	23.4	8.7	Do.
6	19.2	7.5	7.1	23.6	12.9	20.1	9.6	Few.
7	22.9	25.5	18.6	8.1	9.1	9.6	6.2	Very few.

[a] The solution loss is obtained by treating the sample with hydrogen peroxide and washing.

TABLE 4.—*Average chemical analyses of different types of subaqueous horizon and the growth of algæ.*

Type of subaqueous horizon.	Nitrogen (N).	Phosphoric anhydride (P_2O_5).	Potash (K_2O).	Organic matter.[a]	Growth of algæ.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	
1	0.346	0.136	0.948	24.48	Very abundant.
2	0.248	0.176	0.617	15.56	Abundant.
3	0.363	0.107	0.826	16.11	Very abundant.
4	0.205	0.117	0.760	12.88	Abundant.
5	0.119	0.086	0.861	9.30	Do.
6	0.098	0.107	0.767	7.78	Few.
7	0.051	0.107	0.799	5.75	Very few.

[a] Organic matter was obtained by the loss on ignition.

Bataan, Rizal, and Cavite Provinces have fishponds located near the sea with subaqueous horizons of varying texture depending upon the distance of the pond from the seashore and the type of soil in the immediate vicinity.

The subaqueous horizons of fishponds in Balanga, Bataan Province, consist mostly of fine sandy mud. In Malabon and Caloocan, Rizal Province, they are composed chiefly of fine sand. In Parañaque and Las Piñas, Rizal, they are a sandy mud that is black to dark gray in color; and in Bacoor and Noveleta, Cavite, they are also sandy mud.

EXPERIMENTAL PROCEDURE

Mechanical and chemical analyses were made of the individual soil samples included in each soil type. The analytical results of the samples included in each type were then averaged in order to get the mean results for each particular type.

Average mechanical analyses of the different types of subaqueous horizons are given in Table 3, and in Table 4 are given the average chemical analyses. Included in these tables are also notes on the growth of algæ corresponding to various types of subaqueous horizons.

The mechanical analyses were made in accordance with the method of Olmstead, Alexander, and Middleton. The methods of the Association of Official Agricultural Chemists were used for the chemical analyses. The elements determined were nitrogen, phosphorus, and potassium. Organic matter was ascertained by the loss on ignition.

SUMMARY

A preliminary investigation of the soils of some fishponds bordering on Manila Bay was carried out.

Data from the mechanical and chemical analyses (Tables 3 and 4) indicate that, in general, algæ seem to grow very abundantly in types of subaqueous horizons that have a high-solution loss and a high content of clay, nitrogen, and organic matter. Types that are deficient in these characteristics generally have very few algæ.

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DIATOMS FROM KIZAKI LAKE, HONSHU ISLAND NIPPON

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SIXTEEN PLATES

In presenting this list of the diatoms that I found in Kizaki Lake, Shinano Province, Honshu Island, Nippon, I wish to offer some general results of the investigation.

The diatom material was collected in July, 1927, by Mr. K. Kiuchi, and sent to me through the kindness of Prof. Dr. T. Kawamura, director of the Zoölogical Institute, College of Science, Kyoto Imperial University. The material consisted of a glass tube with mud from the lake. The crude material was first examined under the microscope, by the use of magnifying powers ranging from 100 to 600 diameters, and only a few diatoms were discovered. When the mud was prepared for accurate investigation I found thousands of siliceous algæ. The material was boiled in commercial hydrochloric acid for one-half hour. The acid when cold was decanted, and the residue washed with water to get rid of the resultant salts. After a few days the material was boiled in concentrated commercial sulphuric acid for one-half hour, after which powdered potassium chlorate was slowly added to the boiling acid until the black color gave place to yellow. A week was spent in removing the traces of acids and salts from the material. The prepared diatoms were preserved in alcohol. The diatom material was mounted in coumarone-piperin and mercuric iodide (HgI_2), proposed by Dr. R. W. Kolbe. I have examined a hundred microscopic slides with apochromat 2 mm E. Leitz, Wetzlar, and compensating oculars 6, 8, and 12. Half a year was spent in the study of this collection.

The diatom flora of Kizaki Lake is rich. The slides examined yielded 338 forms, a list of which is given below. Diatoms, especially those living in fresh water, are known to be very cosmopolitan in their habitats. Nevertheless, there are certain species characteristic of alpine and Arctic regions, and others

of warm climates. The diatom flora of Kizaki Lake is largely represented by various species of *Melosira* and *Cyclotella* and, especially, naviculoid forms, which are abundant in colder waters. Northern, Arctic, and alpine species predominate; tropical elements are richly represented. The alpine and Arctic diatoms are the following:

Melosira distans.
Melosira italica var. *valida.*
Cyclotella glomerata.
Diatoma hiemale.
Eunotia praerupta.
Eucocconeis flexella.
Achnanthes lanceolata var. *elliptica.*
Frustulia rhomboides.
Neidium bisulcatum.
Neidium Kozlowi.
Diploneis marginestriata.
Navicula Rotaeana.
Pinnularia leptosoma.
Cymbella naviculiformis.
Cymbella aequalis.
Cymbella heteropleura var. *minor.*
Cymbella gracilis.
Cymbella alpina.
Gomphonema quadripunctatum.
Rhopalodia parallela.

It is interesting to note that *Neidium Kozlowi* is reported from central Asia and *Gomphonema quadripunctatum* from Baikal Lake, northern Europe, and Mongolia.

To tropical elements must be referred the following species:

Melosira americana.
Melosira undulata var. *Normanni.*
Actinella brasiliensis.
Eunotia tropica.
Neidium oblique-striatum var.
Navicula confervacea.
Amphora delphinea.
Cymbella turgidula.
Cymbella turgida.
Gomphonema gracile.
Gomphonema Berggrenii.
Epithemia cistula var. *lunaris.*
Surirella Terryana.

Such diatoms as *Melosira americana, Neidium oblique-striatum,* and *Surirella Terryana* occur in South America. A peculiar diatom, *Actinella brasiliensis,* is still living in Nippon, occurs in Demerara River in Guiana, South America, and is known as a fossil in the southern part of France. *Gomphonema Berggrenii* was described from New Zealand; *Epithemia cistula* is living in India and southern China, and is reported as a fossil in Hungary.

The brackish-water species from Kizaki waters are represented by the following:

Fragilaria construens var. *subsalina.*
Achnanthes Hauckiana.
Rhoicosphenia curvata.
Diploneis Smithii var.
Navicula protracta.
Navicula holophila forma *minor.*
Navicula salinarum var.
Pinnularia viridis var. *leptogongyla.*

Large new forms of *Diploneis Smithii* found in Kizaki Lake seem to belong to alpine species. The type of *Diploneis Smithii*

is known from brackish waters. Two fossil diatoms were discovered in Kizaki Lake. These are *Pinnularia lignitica,* originally reported from Nippon lignite, and *Cymbella sinuata* var. *antiqua,* from Hungary.

The endemic diatoms in Kizaki Lake are represented by the following species:

Ceratoneis arcus var. *Hattoriana.*
Synedra japonica.
Achnanthes pinnata var. *japonica.*
Navicula subdicephala.
Navicula globulifera.
Pinnularia divergens var. *japonica.*
Pinnularia lignitica.
Pinnularia platycephala var. *Hattoriana.*
Pinnularia montana var.
Cymbella japonica.
Gomphonema vastum.
Gomphonema lingulatum.
Nitzschia interrupta.
Surirella robusta forma *lata.*
Surirella Capronii var. *obtusa.*
Surirella Pantoscekii.

All these diatoms were described by Reichelt, Meister, Hustedt, and Cleve. The present list contains the names of 94 new diatoms, and they are also endemic to this country. This note is illustrated with drawings by the author, which will be of use in future investigations.

MELOSIRA VARIANS C. A. Ag. Plate 2, fig. 33.

Melosira varians C. A. Ag., Fr. Hustedt, Bacillar. (1930) 85, fig. 41.

Frustules 0.015 mm in breadth. Not common in Kizaki Lake. Known from Nippon.

MELOSIRA GRANULATA (Ehr.) Ralfs. Plate 1, fig. 8.

Melosira granulata (Ehr.) Ralfs, Fr. Hustedt, Bacillar. (1930) 87, fig. 44.

Frustules 0.01 mm in breadth. Rare. Known from Aokiko Lake.

MELOSIRA DISTANS (Ehr.) Kütz. Plate 1, fig. 10.

Melosira distans (Ehr.) Kütz., Fr. Hustedt, Bacillar. (1930) 92–93, fig. 53.

Frustules 0.005 to 0.007 mm in breadth with fine puncta 15 in 0.01 mm. Common in Kizaki and Aokiko Lakes. Known from alpine waters.

MELOSIRA DISTANS (Ehr.) Kütz. var. LIRATA (Ehr.) Bethge. Plate 10, fig. 12.

Melosira distans (Ehr.) Kütz. var. *lirata* (Ehr.) Bethge, Fr. Hustedt, Bacillar. (1930) 93, fig. 55.

A variety with more robust frustules 0.006 to 0.007 mm in breadth. Striæ 10 in 0.01 mm. Rather common in Kizaki

Lake. The variety *africana* O. Mull., found by Fr. Hustedt in Aokiko Lake, was not seen in Kizaki Lake.

MELOSIRA AMERICANA Kütz. Plate 1, fig. 1.

Melosira americana KÜTZING, Bacillar (1865) 55, pl. 30, fig. 69; FR. HUSTEDT, Bacillar. a. d. Aokikosee in Japan 156, pl. 5, fig. 8.

Frustules cylindrical, barrel-shaped, 0.012 to 0.015 mm in diameter, with spinous junctions. This species is fairly abundant in Kizaki Lake. *Melosira americana* was described by Kützing from tropical America in 1865 and found by Fr. Hustedt in Aokiko Lake in Nippon.

MELOSIRA BINDERANA Kütz. Plate 1, figs. 3 and 4; Plate 10, fig. 6.

Melosira Binderana Kütz., FR. HUSTEDT, Bacillar. (1930) 86–87, fig. 43.

A distinct species with small, slightly siliceous frustules. Breadth, 0.004 to 0.005 mm. Common in Kizaki Lake. Known from Europe and Asia.

MELOSIRA UNDULATA (Ehr.) Kütz. var. NORMANNI Arnott. Plate 1, fig. 2.

Melosira undulata (Ehr.) Kütz. var. *Normanni* Arnott, VAN HEURCK, Synopsis pl. 90, fig. 7.

A very robust species with frustules 0.027 to 0.03 mm in breadth. This tropical diatom is known from Aokiko Lake in Nippon, southern China, and Java, and is a fossil in Europe.

MELOSIRA ITALICA (Ehr.) Kütz. var. TENUISSIMA (Grun.) O. Mull. Plate 1, fig. 6.

Melosira italica (Ehr.) Kütz. var. *tenuissima* (Grun.) O. Mull., VAN HEURCK, Synopsis pl. 88, fig. 11.

A delicate form with frustules 0.004 mm in breadth. Common in Kizaki Lake.

MELOSIRA ITALICA (Ehr.) Kütz. var. VALIDA Grun. Plate 1, fig. 7.

Melosira italica (Ehr.) Kütz. var. *valida* Grun., FR. HUSTEDT, Bacillar. (1930) 94, fig. 51.

A distinct form with frustules 0.02 to 0.03 mm in breadth and 0.027 to 0.03 mm in length. Puncta 12 in 0.01 mm. Very common in Kizaki and Aokiko Lakes in Nippon. Known from subalpine regions.

MELOSIRA ITALICA (Ehr.) Kütz. subsp. SUBARCTICA O. Mull. Plate 1, fig. 5.

Melosira italica (Ehr.) Kütz. subsp. *subarctica* O. Mull., FR. HUSTEDT, Bacillar. (1930) 92, fig. 52.

Frustules in long filaments, 0.0076 to 0.008 mm in breadth. Striæ 18 in 0.01 mm. Puncta 24 in 0.01 mm. Known from Nippon.

CYCLOTELLA STELLIGERA Cleve and Grun. Plate 1, fig. 11.

Cyclotella stelligera Cleve and Grun., FR. HUSTEDT, Bacillar. (1930) 100, fig. 65.

A distinct species with a ring of alveoli in the center of the valve. Diameter of the valve 0.012 mm. Striæ 13 in 0.01 mm. Not common. Known from Aokiko Lake.

CYCLOTELLA GLOMERATA Bachmann fo. NIPPONICA fo. nov. Plate 1, fig. 12.

A little species with circular valve consisting of a hyaline central area, one-half the diameter of the valve, and a rim of transverse striæ. Diameter of the valve, 0.0036 to 0.004 mm. Striæ 18 in 0.01 mm. Differs from the type in its coarser striæ. *Cyclotella glomerata* is known from subarctic lakes of Europe.

CYCLOTELLA MENEGHINIANA Kütz. var. NIPPONICA var. nov. Plate 8, fig. 14.

This new variety differs from the type by a ring of scattered beads near the marginal rim of the transverse striæ. Diameter of the valve, 0.012 mm. Striæ robust, 7 in 0.01 mm. Occasional in Kizaki Lake.

CYCLOTELLA COMTA (Ehr.) Kütz.

Cyclotella comta (Ehr.) Kütz., VAN HEURCK, Synopsis pl. 92, figs. 16–23.

Valve circular; consisting of a large central area, two-thirds the diameter of the valve and a rim one-third the valve diameter; the former with puncta finely distributed over the entire valve in rows radial from the center. Rim ornamented with delicate transverse striæ. Diameter of the valve, 0.001 to 0.045 mm. Very common in Kizaki Lake. Known from Aokiko Lake.

CYCLOTELLA COMTA (Ehr.) Kütz. var. PAUCIPUNCTATA Grun. Plate 12, fig. 2.

Cyclotella comta (Ehr.) Kütz. var. *paucipunctata* Grun., VAN HEURCK, Synopsis pl. 93, fig. 20.

A variety with a small central area, with scattered beads forming a star in the center. Diameter of the valve, 0.012 mm. Striæ 18 in 0.01 mm. Very rare. Known from Aokiko Lake in Nippon.

CYCLOTELLA COMTA (Ehr.) Kütz. fo. PARVA fo. nov. Plate 8, fig. 13.

Differs from the type in its smaller valve. Diameter of the valve, 0.0042 to 0.006 mm. Common in Kizaki Lake.

STEPHANODISCUS ASTRAEA (Ehr.) Grun.

Stephanodiscus astraea (Ehr.) Grun., VAN HEURCK, Synopsis (1880–1881) pl. 95, figs. 5, 6.

A common diatom in Kizaki Lake. Known from Aokiko Lake.

TABELLARIA FLOCCULOSA (Roth.) Kütz. Plate 1, fig. 16.

Tabellaria flocculosa (Roth.) Kütz., Fr. Hustedt, Bacillar. (1930) 123–124, fig. 101.

Valve linear with median inflation larger than the terminal. Common in Kizaki Lake.

TABELLARIA FENESTRATA (Lyngb.) Kütz. Plate 1, fig. 35.

Tabellaria fenestrata (Lyngb.) Kütz., Fr. Hustedt, Bacillar. (1930) 122–123, fig. 99.

Valve linear, gibbous in the middle. Ends capitate. Length, 0.068 mm; breadth, 0.0045. Striæ 18 in 0.01 mm. Uncommon in Kizaki Lake.

DIATOMA VULGARE Bory var. LINEARIS Grun. Plate 10, fig. 7.

Diatoma vulgare Bory var. *linearis* Grun., A. Schmidt, Atlas Diatom. pl. 265, figs. 11–17.

Valve linear with slightly truncate end. Length, 0.024 mm; breadth, 0.0034. Striæ 15 in 0.01 mm. Not common.

DIATOMA HIEMALE (Lyngb.) Heiberg. Plate 1, fig. 24; Plate 2, fig. 34; Plate 10, fig. 13.

Diatoma hiemale (Lyngb.) Heiberg, Fr. Hustedt, Bacillar. (1930) 129, fig. 115.

Valve lanceolate, obtuse. Length, 0.02 to 0.03 mm; breadth, 0.006 to 0.005. An alpine species.

DIATOMA HIEMALE (Lyngb.) Heiberg var. MESODON (Ehr.) Grun. Plate 1, fig. 13; Plate 9, fig. 18; Plate 10, fig. 25.

Diatoma hiemale (Lyngb.) Heiberg var. *mesodon* (Ehr.) Grun., Fr. Hustedt, Bacillar. (1930) 129, fig. 116.

Valve broad elliptic. Length, 0.012 to 0.017 mm; breadth, 0.007. An alpine diatom reported from Aokiko Lake.

MERIDION CIRCULARE Agardh. Plate 1, fig. 19.

Meridion circulare Agardh, Fr. Hustedt, Bacillar. (1930) 130–131, fig. 118.

Valve clavate. Length, 0.032 mm; breadth, 0.0045. Costæ 4 in 0.01 mm. Not common. Known from springs and mountain streams.

MERIDION CIRCULARE Agardh var. CONSTRICTA (Ralfs) Van Heurck. Plate 10, fig. 28.

Meridion circulare Agardh var. *constricta* (Ralfs) Van Heurck, Fr. Hustedt, Bacillar. (1930) 131, fig. 119.

Valve clavate with constricted capitate ends. Length, 0.03 mm; breadth, 0.004. Not common.

OPEPHORA MARTYI Heribaud. Plate 2, fig. 27; Plate 13, fig. 3.

Opephora Martyi Heribaud, Fr. Hustedt, Bacillar. (1930) 132–133, fig. 120.

Valve broad-ovate, or elongate, rounded at one end and acute at the other. Length, 0.0076 to 0.012 mm; breadth, 0.0025 to 0.003. Costæ 12 in 0.01 mm. Common in Kizaki Lake. Known from Aokiko Lake.

OPEPHORA MARTYI Heribaud var. ROBUSTA var. nov. Plate 12, fig. 8; Plate 13, fig. 10.

Valve robust; convex, attenuate towards the ends. Ends broad-obtuse. Length, 0.023 to 0.042 mm; breadth, 0.0068 to 0.009. Costæ 5 to 6 in 0.01 mm. Common.

OPEPHORA MARTYI Heribaud var. ELONGATA var. nov. Plate 13, fig. 12.

Valve long-ovate. One end much broader than the other. Length, 0.015 mm; breadth, 0.005. Costæ 9 in 0.01 mm. A distinct variety.

OPEPHORA OKADÆ sp. nov. Plate 12, fig. 6.

Valve claviform with subtruncate and usually constricted apex. End attenuate, constricted and capitate. Central area linear. Length, 0.024 to 0.03 mm; breadth, 0.0042 to 0.005. Costæ 7 in 0.01 mm. A species distinct from *O. Martyi* Heribaud. Named in honor of Dr. Yoshikazo Okada, of Tokyo.

CERATONEIS ARCUS Kütz. var. HATTORIANA Meister. Plate 1, fig. 38.

Ceratoneis arcus Kütz. var. *Hattoriana* Meister, Beiträge zur Bacillar. Japan 2 (1914) 226–227, pl. 8, figs. 1–3.

Valve linear with rostrate ends. Length, 0.061 mm; breadth, 0.005. Striæ 12 in 0.01 mm. Not common in Kizaki Lake. Reported from Yokohama.

CERATONEIS ARCUS Kütz. var. AMPHIOXYS (Rabh.). Plate 2, fig. 36; Plate 9, figs. 13 and 16.

Ceratoneis arcus Kutz. var. *amphioxys* (Rabh.), Fr. Hustedt, Bacillar. (1930) 135, fig. 123.

Valve lanceolate with asymmetrical sides. Length, 0.017 to 0.032 mm; breadth, 0.0045 to 0.006. Striæ 15 to 18 in 0.01 mm. Common in Kizaki Lake.

FRAGILARIA HARRISSONII W. Smith. Plate 16, fig. 5.

Fragilaria Harrissonii W. Smith, Fr. Hustedt, Bacillar. (1930) 139–140, fig. 132.

Valve broad, cross-shaped with rounded ends. Length, 0.014 mm; breadth, 0.008. Pseudoraphe narrow. Costæ very distinct. A fresh-water diatom.

FRAGILARIA HARRISSONII W. Smith var. RHOMBOIDES Grun. Plate 14, fig. 8.

Fragilaria Harrissonii W. Smith var. *rhomboides* Grun., FR. HUSTEDT, Bacillar. (1930) 140, fig. 133.

Valve broad-lanceolate. Length, 0.01 mm, breadth, 0.005. Costæ robust, 9 in 0.01 mm.

FRAGILARIA HARRISSONII W. Smith var. DUBIA Grun. Plate 16, fig. 6.

Fragilaria Harrissonii W. Smith var. *dubia* Grun., FR. HUSTEDT, Bacillar. (1930) 140, fig. 134.

Valve lanceolate with attenuate and capitate ends. Length, 0.0187 mm; breadth, 0.005. Costæ robust, 9 in 0.01 mm. Not common. Known in European lakes.

FRAGILARIA PINNATA Ehr. Plate 1, fig. 9; Plate 12, fig. 21.

Fragilaria pinnata Ehr., FR. HUSTEDT, Bacillar. (1930) 142, fig. 141b.

Valve elliptical, with broad ends. Length, 0.0034 to 0.006 mm; breadth, 0.0027 to 0.0034. Costæ 12 in 0.01 mm. A freshwater diatom. In Kizaki Lake variety *lancettula* is reported.

FRAGILARIA CROTONENSIS Kitton. Plate 1, fig. 26.

Fragilaria crotonensis Kitton, FR. HUSTEDT, Bacillar. (1930) 137–138, fig. 125.

Valve linear-lanceolate with long-acuminate ends. Length, 0.12 to 0.015 mm; breadth, 0.003. Striæ 12 to 13 in 0.01 mm. Common in fresh water. Known from Aokiko Lake.

FRAGILARIA GRACILLIMA Mayer. Plate 1, fig. 23.

Fragilaria gracillima Mayer, FR. HUSTEDT, Bacillar. (1930) 139, fig. 131.

Valve long-lanceolate with capitate and constricted ends. Pseudoraphe very narrow, indistinct. Length, 0.018 mm; breadth, 0.002. Striæ very fine, 24 in 0.01 mm. This species is reported from Germany only.

FRAGILARIA CAPUCINA Desm. Plate 1, fig. 21.

Fragilaria capucina Desm., FR. HUSTEDT, Bacillar. (1930) 138, fig. 126.

Valve sublinear with slightly rostrate and obtuse ends. Length, 0.04 mm; breadth, 0.004. Striæ 12 in 0.01 mm. Pseudoraphe very narrow. In the middle part of the valve the striæ are interrupted, forming a quadrate central area. A plankton species, known also from Aokiko Lake in Nippon.

FRAGILARIA VIRESCENS Ralfs. Plate 9, fig. 15.

Fragilaria virescens Ralfs, FR. HUSTEDT, Bacillar. (1930) 142, fig. 144.

Valve lanceolate, rostrate and obtuse. Length, 0.017 mm; breadth, 0.005. Striæ 18 in 0.01 mm. Pseudoraphe very

narrow and linear. Very common in Kizaki Lake. Known from many parts of the world.

FRAGILARIA VIRESCENS Ralfs var. ELLIPTICA Hustedt fo. NIPPONICA fo. nov. Plate 12, fig. 20.

Valve lanceolate, dilated, obtuse, not rostrate. Length, 0.009 mm; breadth, 0.003. Striæ 18 in 0.01 mm. This form differs from variety *elliptica* in having narrower valves.

FRAGILARIA BREVISTRIATA Grun. Plate 14, fig. 9.

Fragilaria brevistriata Grun., FR. HUSTEDT, Bacillar. (1930) 145, fig. 151.

Valve lanceolate with acute ends. Length, 0.015 mm; breadth, 0.0034. Striæ 18 in 0.01 mm, marginal. Common.

FRAGILARIA BREVISTRIATA Grun. var. INFLATA (Pant.) Hustedt fo. CURTA fo. nov. Plate 1, fig. 18.

Valve short, lanceolate, with attenuate, obtuse ends. Length, 0.0085 mm; breadth, 0.0034. Striæ 15 in 0.01 mm. The typical variety *inflata* has a more elongate valve.

FRAGILARIA BREVISTRIATA Grun. var. NIPPONICA var. nov. Plate 16, fig. 7.

Valve lanceolate, biconstricted, with rostrate ends. Length, 0.02 mm; breadth, 0.005. Striæ 15 to 17 in 0.01 mm. This diatom resembles, under a low power, *Fragilaria Magocsyi* Lacsny known from Hungary, from which, however, it is different.

FRAGILARIA CONSTRUENS (Ehr.) Grun. Plate 1, figs. 28 and 29.

Fragilaria construens (Ehr.) Grun., A. SCHMIDT, Atlas Diatom. pl. 296, figs. 40–47.

Valve broad-lanceolate with rostrate ends. Length, 0.008 to 0.01 mm; breadth, 0.004 to 0.006. Striæ 15 to 18 in 0.01 mm. This diatom is widely distributed in fresh waters.

FRAGILARIA CONSTRUENS (Ehr.) Grun. var. SUBSALINA Hustedt. Plate 11, fig. 19.

Fragilaria construens (Ehr.) Grun. var. *subsalina* HUSTEDT, Bacillar. (1930) 141, fig. 139.

Valve linear-lanceolate with obtuse ends. Length, 0.012 mm; breadth, 0.0032. Striæ 15 in 0.01 mm. This variety differs from the type in its narrower valves. It is known from brackish waters of Europe.

FRAGILARIA CONSTRUENS (Ehr.) Grun. var. TRIUNDULATA Reichelt. Plate 10, fig. 32.

Fragilaria construens (Ehr.) Grun. var. *triundulata* Reichelt, Fr. Hustedt, Bacillar. (1930) 140, fig. 136.

Valve lanceolate, triundulate with rostrate ends. Length, 0.02 mm; breadth, 0.005. Striæ 18 in 0.01 mm. Pseudoraphe linear. Not common in Kizaki Lake.

FRAGILARIA CONSTRUENS (Ehr.) Grun. var. BINODIS (Ehr.) Grun. Plate 1, fig. 17; Plate 16, fig. 9.

Fragilaria construens (Ehr.) Grun. var. *binodis* (Ehr.) Grun., Fr. Hustedt, Bacillar. (1930) 140–141, fig. 137.

Valve biconstricted. Length, 0.017 to 0.02 mm; breadth, 0.005 to 0.006. Striæ 15 in 0.01 mm. Variety *binodis* is reported from Aokiko Lake.

FRAGILARIA CONSTRUENS (Ehr.) Grun. var. NIPPONICA var. nov. Plate 10, fig. 15; Plate 16, fig. 13.

Valve minute, broad-lanceolate with rostrate ends; constricted from one or from both sides. Length, 0.009 to 0.011 mm; breadth, 0.005. Striæ 15 in 0.01 mm. This differs from variety *binodis* in its shorter valves.

ASTERIONELLA GRACILLIMA (Hantzsch) Heiberg. Plate 1, figs. 33 and 34.

Asterionella gracillima (Hantzsch) Heiberg, Fr. Hustedt, Bacillar. (1930) 147, fig. 157.

Valve linear with capitate ends. Length, 0.072 to 0.08 mm; breadth, 0.002. Abundant in Kizaki Lake.

SYNEDRA NANA Meister var. NIPPONICA var. nov. Plate 10, fig. 29.

Valve sublinear, attenuate towards the ends. Length, 0.026 to 0.049 mm; breadth, 0.0017 to 0.002. Striæ marginal, very fine, about 30 to 35 in 0.01 mm. Differs from the type in its slightly convex margins.

SYNEDRA ULNA (Nitzsch) Ehr. Plate 1, fig. 36; Plate 3, fig. 8.

Synedra Ulna (Nitzsch) Ehr., Fr. Hustedt, Bacillar. (1930) 151, fig. 159.

Valve linear-lanceolate with broad ends. Length, 0.136 to 0.221 mm; breadth, 0.006 to 0.008. Striæ 9 to 10 in 0.01 mm. Common in fresh water.

SYNEDRA ULNA (Nitzsch) Ehr. var. RAMESI (Herib. and Perag.) Hustedt. Plate 1, fig. 37.

Synedra Ulna (Nitzsch) Ehr. var. *Ramesi* (Herib. and Perag.) Hustedt, Fr. Hustedt, Bacillar. (1930) 152, fig. 163.

Valve linear-lanceolate, little constricted and with truncate ends. Length, 0.054 mm; breadth, 0.006. Striæ 11 to 12 in 0.01 mm. Uncommon.

SYNEDRA ULNA (Nitzsch) Ehr. var. BICEPS (Kütz.) Plate 1, fig. 39.

Synedra Ulna (Nitzsch) Ehr. var. *biceps* (Kütz.), Fr. Hustedt, Bacillar. (1930) 154, fig. 166.

Valve long, linear with capitate ends. Length, 0.2 to 0.25 mm; breadth, 0.0045. Striæ 8.5 in 0.01 mm. Common in Kizaki Lake.

SYNEDRA ULNA (Nitzsch) Ehr. var. DANICA (Kütz.) Grun. Plate 10, fig. 10.

Synedra Ulna (Nitzsch) Ehr. var. *danica* (Kütz.) Grun., Fr. Hustedt, Bacillar. (1930) 154, fig. 168.

Valve lanceolate, attenuated towards the ends. Ends slightly subtruncate and constricted. Length, 0.17 mm; breadth, 0.005. Striæ 9 in 0.01 mm.

SYNEDRA GOULARDI (Breb.) Grun. Plate 10, fig. 22.

Synedra Goulardi (Breb.) Grun., A. Schmidt, Atlas Diatom. pl. 300, figs. 10–18.

Valve deeply constricted with truncate-rostrate ends. Length, 0.039 mm; breadth, 0.0065. Striæ 15 in 0.01 mm. Known from Demerara River, Paraguay, and from Victoria Lake, Africa.

SYNEDRA RUMPENS Kütz. var. MENEGHINIANA Grun. Plate 3, fig. 22.

Synedra rumpens Kütz. var. *Meneghiniana* Grun., Fr. Hustedt, Bacillar. (1930) 156, fig. 178.

Valve lanceolate with truncate ends. Length, 0.03 mm; breadth, 0.035. Striæ 12 in 0.01 mm. Not common.

SYNEDRA RUMPENS Kütz. var. NIPPONICA var. nov. Plate 1, fig. 20.

Valve sublinear, narrowly attenuated towards the ends. Striæ very fine, 30 in 0.01 mm, interrupted in the middle part, forming a rectangular area. Length, 0.03 mm; breadth, 0.003. Differs from the type in its fine striæ.

SYNEDRA CYCLOPUM Brutschi var. NIPPONICA var. nov. Plate 13, fig. 37.

Valve linear-lanceolate, sigmoid, attenuate towards the ends. Length, 0.018 mm; breadth, 0.002. Striæ 18 in 0.01 mm. The typical forms of *Synedra cyclopum* have the valves larger and they are curved to one side. *Synedra cyclopum* is reported from Europe.

SYNEDRA JAPONICA Meister. Plate 1, fig. 27; Plate 10, fig. 9.

Synedra japonica MEISTER, Beiträge zur Bacillar. Japans (1913) 307, figs. 5–6.

Valve linear-lanceolate with long capitate horns. Length, 0.144 to 0.187 mm; breadth, 0.0028 to 0.003. Striæ 11 to 13 in 0.01 mm, interrupted in the middle and forming a quadrate area. Pseudoraphe very narrow. Common in Kizaki Lake. Known from Suwa Lake, Nippon.

SYNEDRA VAUCHERIÆ Kütz. Plate 1, fig. 14.

Synedra Vaucheriæ Kütz., FR. HUSTEDT, Bacillar. (1930) 161, fig. 192.

Valve lanceolate, broad and obtuse. Length, 0.012 mm; breadth, 0.0025. Striæ 16 in 0.01 mm. Common in Kizaki Lake.

SYNEDRA VAUCHERIÆ Kütz. var. CAPITELLATA Grun. Plate 1, fig. 15; Plate 2, fig. 28.

Synedra Vaucheriæ Kütz. var. *capitellata* Grun., FR. HUSTEDT, Bacillar. (1930) 161, fig. 194.

Valve lanceolate, attenuate towards the ends. Ends capitate. Length, 0.018 to 0.023 mm; breadth, 0.0028 to 0.0042. Striæ 12 to 16 in 0.01 mm.

SYNEDRA VAUCHERIÆ Kütz. var. SIGMOIDEA var. nov. Plate 1, fig. 42.

Valve lanceolate, sigmoid, with capitate ends, turned opposite. Length, 0.02 mm; breadth, 0.004. Striæ fine, 18 in 0.01 mm. Not common in Kizaki Lake.

SYNEDRA PARASITICA (W. Smith). Plate 1, fig. 22.

Fragilaria parasitica W. Smith, A. SCHMIDT, Atlas Diatom. pl. 296, figs. 76–80.

Valve lanceolate, convex, with produced ends. Pseudoraphe wide. Length, 0.012 to 0.02 mm; breadth, 0.004 to 0.005. Striæ 18 in 0.01 mm. Meister described *Fragilaria parasitica* var. *asterionellodes* from Nippon, a variety forming asterionelloid colonies.

SYNEDRA NIPPONICA sp. nov. Plate 1, fig. 43.

Valve minute, lanceolate, attenuate towards the ends. Pseudoraphe very narrow. Length, 0.01 mm; breadth, 0.002. Striæ 18 in 0.01 mm. A species related to *Synedra parasitica.*

ACTINELLA BRASILIENSIS Grun. Plate 8, fig. 11.

Actinella brasiliensis Grun., A. SCHMIDT, Atlas Diatom. pl. 292, figs. 10–19.

Valve linear, inflated at one end, capitate and apiculate. Length, 0.088 mm; breadth, 0.013. Striæ 10 in 0.01 mm. Not common in Kizaki Lake. Reported from Brazil, Chosen, and Hanka Lake in Siberia, and as a fossil in southern Europe.

EUNOTIA SEPTENTRIONALIS Oestrup. Plate 12, fig. 23.

Eunotia septentrionalis Oestrup, FR. HUSTEDT, Bacillar. (1930) 179, fig. 232.

Valve lanceolate with gibbous dorsal and parallel ventral sides. Length, 0.0136 mm; breadth, 0.0034. Striæ 18 in 0.01 mm. Not common in Kizaki Lake. Reported from Germany as a relict.

EUNOTIA TROPICA Hustedt. Plate 8, figs. 10 and 16.

Eunotia tropica HUSTEDT, Bacillar a. d. Aokikosee in Japan 159, pl. 5, fig. 1.

Valve robust with four or five undulations on the dorsal side. Length, 0.078 to 0.088 mm; breadth, 0.017. Striæ 8 to 9 in 0.01 mm. Uncommon in Kizaki Lake. Known from Aokiko Lake, from Foochow, southern China, and, according to Fr. Hustedt, from the Tropics.

EUNOTIA FABA (Ehr.) Grun. var. NIPPONICA var. nov. Plate 14, fig. 4.

Valve linear and obtuse. Length, 0.013 to 0.016 mm; breadth, 0.0028 to 0.003. Striæ fine, 18 in 0.01 mm. Typical *Eunotia faba* has larger valves, and is an alpine plant.

EUNOTIA PALUDOSA Grun. Plate 1, fig. 25.

Eunotia paludosa Grun., FR. HUSTEDT, Bacillar. (1930) 178, fig. 228.

Valve linear, curved, with rostrate-truncate ends. Length, 0.047 mm; breadth, 0.005. Striæ 12 in 0.01 mm. Reported from Europe.

EUNOTIA LUNARIS (Ehr.) Grun. Plate 1, fig. 44.

Eunotia lunaris (Ehr.) Grun., FR. HUSTEDT, Bacillar. (1930) 183, fig. 249.

Valve linear, curved. Length, 0.085 mm; breadth, 0.0025. Striæ 18 in 0.01 mm. Uncommon in Kizaki Lake.

EUNOTIA GRACILIS (Ehr.) Rabh. Plate 1, fig. 40.

Eunotia gracilis (Ehr.) Rabh., FR. HUSTEDT, Bacillar. (1930) 185, fig. 253.

Valve long, curved, with capitate ends. Length, 0.111 mm; breadth, 0.005. Striæ 12 in 0.01 mm. Occasional in Kizaki Lake.

EUNOTIA VALIDA Hustedt. Plate 1, fig. 41.

Eunotia valida HUSTEDT, Bacillar. (1930) 178, fig. 229.

Valve linear, robust, with obtuse ends. Length, 0.096 mm; breadth, 0.0042. Striæ 12 in 0.01 mm. Reported from wet rocks from Europe.

EUNOTIA VENERIS (Kütz.) O. Mull. var. NIPPONICA var. nov. Plate 1, fig. 31.

Valve lanceolate-attenuate towards the ends. Length, 0.0187 mm; breadth, 0.0034. Striæ 15 in 0.01 mm. Differs from the type in having broader ends.

EUNOTIA PRÆRUPTA Ehr. Plate 12, fig. 25.

Eunotia praerupta Ehr., FR. HUSTEDT, Bacillar. (1930) 174, fig. 211.

Valve robust, curved, with convex dorsal sides. Length, 0.051 mm; breadth, 0.01. Striæ 12 to 15 in 0.01 mm. An alpine diatom.

EUNOTIA PECTINALIS (Kütz.) Rabh. var. MINOR (Kütz.) Rahb. Plate 1, fig. 30.

Eunotia pectinalis (Kütz.) Rabh. var. *minor* (Kütz.) Rabh., FR. HUSTEDT, Bacillar. (1930) 182, fig. 238.

Valve linear, curvate, slightly attenuate and obtuse. Length, 0.03 mm; breadth, 0.006. Striæ 10 to 11 in 0.01 mm. Common in fresh water.

EUNOTIA PECTINALIS (Kütz.) Rabh. var. MINOR (Kütz.) Rabh. fo. IMPRESSA (Ehr.). Plate 14, fig. 10.

Eunotia pectinalis (Kütz.) Rabh. var. *minor* (Kütz.) Rabh. fo. *impressa* (Ehr.), FR. HUSTEDT, Bacillar. (1930) 182, fig. 239.

Valve lanceolate, curvate, constricted on the dorsal side. Length, 0.022 mm; breadth, 0.004. Striæ 15 in 0.01 mm. Common in marsh water.

EUNOTIA PECTINALIS (Kütz.) Rabh. var. NIPPONICA var. nov. Plate 1, fig. 32.

Valve lanceolate, attenuate towards the ends, obtuse. Two interruptions in the middle of the ventral side. Length, 0.019 mm; breadth, 0.0048. Striæ 15 in 0.01 mm. Differs from the type by its interruptions.

COCCONEIS PLACENTULA (Ehr.) var. LINEATA (Ehr.) Cleve. Plate 2, fig. 5.

Cocconeis placentula (Ehr.) var. *lineata* (Ehr.) Cleve, FR. HUSTEDT, Bacillar. (1930) 190, fig. 262.

Valve elliptical with broad ends. Length, 0.022 mm; breadth, 0.012. Striæ 18 to 20 in 0.01 mm. Common in fresh water.

COCCONEIS PLACENTULA (Ehr.) var. KLINORAPHIS Geitler fo. NIPPONICA fo. nov. Plate 2, fig. 8.

Valve elliptical with a curvate median line. Length, 0.039 mm; breadth, 0.018. Striæ 24 in 0.01 mm. Differs from variety *klinoraphis* in its broad rounded ends.

COCCONEIS DIMINUTA Pant.? Plate 2, figs. 16 to 18.

Cocconeis diminuta Pant.?, Fr. Hustedt, Bacillar. (1930) 190, fig. 265.

Valve broadly elliptical. Length, 0.008 to 0.018 mm; breadth, 0.005 to 0.01. Upper valve with linear axial area. Striæ 22 in 0.01 mm. Lower valve with lanceolate axial area with coarse elongate puncta, 12 in 0.01 mm. Common. Known from Nippon.

EUCOCCONEIS FLEXELLA (Kütz.) Plate 2, fig. 39.

Eucocconeis flexella (Kütz.), Fr. Hustedt, Bacillar. (1930) 193, fig. 270.

Valve elliptical with an arcuate median line. Length, 0.035 mm; breadth, 0.015. Common in alpine waters.

ACHNANTHES MICROCEPHALA Kütz. Plate 2, fig. 22.

Achnanthes microcephala (Kütz.) Fr. Hustedt, Bacillar. (1930) 198, fig. 273.

Valve linear with subcapitate ends. Length, 0.018 mm; breadth, 0.0025. Striæ indistinct. Known from fresh water in Europe.

ACHNANTHES KIZAKI sp. nov. Plate 2, fig. 25.

Valve linear, enlarged in the middle, with broad, capitate ends. Length, 0.013 mm; breadth, 0.002. Upper valve with a narrow, linear axial area and a narrow, rectangular, central area. Lower valve with slightly dilated central area. Striæ very fine, about 40 in 0.01 mm. A species related to *A. microcephala* Kütz.

ACHNANTHES HAUCKIANA Grun. Plate 12, fig. 26.

Achnanthes Hauckiana Grun., Fr. Hustedt, Bacillar. (1930) 202, fig. 290.

Valve elliptical, obtuse. Length, 0.015 mm; breadth, 0.005. Upper valve with a linear axial area. Striæ 14 in 0.01 mm. Lower valve with a broad central area. Striæ radiate. Known from hot springs and brackish water.

ACHNANTHES HAUCKIANA Grun. var. ELLIPTICA Schulz. fo. NIPPONICA fo. nov. Plate 14, fig. 6.

Valve elliptical. Length, 0.01 mm; breadth, 0.042. Upper valve with linear axial area. Striæ 18 in 0.01 mm, radiate. Lower valve with a broad central area. Differs from variety *elliptica* in its coarser striæ.

ACHNANTHES OESTRUPII (A. Cleve) Hustedt. Plate 2, figs. 31 and 32; Plate 12, fig. 17.

Achnanthes Oestrupii (A. Cleve) Hustedt, Bacillar. (1930) 257, fig. 301.

Valve broad-elliptical. Length, 0.09 to 0.015 mm; breadth, 0.007 to 0.0085. Upper valve with a linear axial area, on one side of which in the middle of the valve there is a horseshoe-shaped area. Striæ robust, radiate, 12 to 18 in 0.01 mm. Lower valve with a narrow stauros. Striæ very fine, about 35 in 0.01 mm. Known from Europe.

ACHNANTHES CLEVEI Grun. var. NIPPONICA var. nov. Plate 2, fig. 24.

Valve lanceolate, convex, acute, obtuse. Length, 0.014 mm; breadth, 0.005. Upper valve with narrow, linear, axial area. Striæ distinctly punctate, 12 in 0.01 mm, radiate. Puncta 15 in 0.01 mm. Lower valve with narrow central area. Striæ very fine, 20 to 22 in 0.01 mm. Differs from the type in its obtuse ends and differs from variety *rostrata* Hustedt in its broad end. *Achnanthes Clevei* is known from Europe.

ACHNANTHES EXIGUA Grun. Plate 7, fig. 16.

Achnanthes exigua Grun., FR. HUSTEDT, Bacillar. (1930) 201–202, fig. 286.

Valve elliptic with rostrate ends. Length, 0.015 mm; breadth, 0.006. Striæ 24 in 0.01 mm. Known from fresh water and hot springs. Reported from Aokiko Lake.

ACHNANTHES EXIGUA Grun. var. INDICA Skvortzow. Plate 2, fig. 38.

Achnanthes exigua Grun. var. *indica* SKVORTZOW, Diatoms from Calcutta (1935) pl. 1, fig. 3.

Valve minute, broad-ovate. Length, 0.0068 mm; breadth, 0.0042. Upper valve with narrow axial area. Striæ parallel, 18 to 20 in 0.01 mm. Lower valve with narrow axial area, and with central area forming a short stauros with one median shortened stria opposite the stauros. Recently described by me from Calcutta, India.

ACHNANTHES EXIGUA Grun. var. NIPPONICA var. nov. Plate 7, figs. 7 and 8.

Valve elliptical with rostrate ends. Length, 0.012 mm; breadth, 0.0062. Upper valve with a narrow axial area. Striæ

18 in 0.01 mm, parallel, at the ends slightly radiate. Lower valve with a median stria, opposite to the fascia being shortened. The type of *Achnanthes exigua* Grun. differs from variety *nipponica* in its bilateral broad fascia.

ACHNANTHES PERAGALLII Brun and Heribaud. Plate 2, fig. 30.

Achnanthes Peragalli BRUN and HERIBAUD, Diatom. d'Auvergne (1893) 50, pl. 1, fig. 4.

Valve broadly elliptical with apiculate ends. Length, 0.012 mm; breadth, 0.006. Upper valve with lanceolate axial area, on one side of which there is a horseshoe area. Striæ 18 in 0.01 mm. Lower valve with dilated central area. Known from Aokiko Lake.

ACHNANTHES PERAGALLII Brun and Heiribaud var. NIPPONICA var. nov. Plate 2, fig. 10.

Valve lanceolate, convex, with long-attenuate ends. Length, 0.025 mm; breadth, 0.0085. Upper valve with a broad, axial area. Central area of the lower valve with a broad stauros. Differs from the type in its more elongate shape. Common in Kizaki Lake.

ACHNANTHES GRACILLIMA Hustedt var. NIPPONICA var. nov. Plate 4, figs. 3 and 4; Plate 6, fig. 9.

Valve slightly siliceous, narrow-lanceolate with attenuate and capitate ends. Length, 0.015 to 0.018 mm; breadth, 0.0034 to 0.0036. Upper valve with indistinct axial area. Lower valve with a narrow axial area outwardly dilated. Striæ very fine, indistinct. Common in Kizaki Lake. The type is reported from Aokiko Lake.

ACHNANTHES AFFINIS Grun. var. MINUTA var. nov. Plate 10, fig. 27.

Valve linear-lanceolate with obtuse ends. Length, 0.0085 mm; breadth, 0.0017. Upper valve with a narrow axial area. Striæ radiate, very fine, in the middle 30, at the ends 40, in 0.01 mm. Lower valve with a dilated central area. The type of *Achnanthes affinis* occurs in fresh waters of Europe, Tasmania, and North America.

ACHNANTHES MINUTISSIMA Kütz. Plate 2, figs. 15 and 23.

Achnanthes minutissima Kütz., FR. HUSTEDT, Bacillar. (1930) 198, fig. 274.

Valve linear with attenuate and obtuse ends. Length, 0.013 to 0.022 mm; breadth, 0.002 to 0.005. Striæ 28 in 0.01 mm or very fine and indistinct. Not common.

ACHNANTHES MINUTISSIMA Kütz. var. CRYPTOCEPHALA Grun. Plate 2, fig. 21.

Achnanthes minutissima Kütz. var. *cryptocephala* Grun., FR. HUSTEDT, Bacillar. (1930) 198, fig. 275.

Valve linear with capitate ends. Length, 0.015 mm; breadth, 0.002. Striæ 30 in 0.01 mm. Uncommon.

ACHNANTHES LINEARIS W. Smith var. PUSILLA Grun. Plate 10, fig. 17.

Achnanthes linearis W. Smith var. *pusilla* Grun., FR. HUSTEDT, Bacillar. (1930) 198, fig. 277.

Valve elongate-linear with obtuse ends. Length, 0.012 mm; breadth, 0.002. Striæ widened in the middle part of the valve, 24 in 0.01 mm. Known from Greenland and Norway.

ACHNANTHES LANCEOLATA Breb. Plate 2, figs. 11 and 12.

Achnanthes lanceolata Breb., FR. HUSTEDT, Bacillar. (1930) 207, fig. 306a.

Valve elliptic-lanceolate, ends obtuse. Length, 0.0136 mm; breadth, 0.005. Upper valve with lanceolate axial area and with a horseshoe area on one of the sides. Lower valve with a quadrate or rectangular central area. Striæ 15 in 0.01 mm. Common in fresh water. Known from Aokiko Lake.

ACHNANTHES LANCEOLATA Breb. var. ELLIPTICA Cleve. Plate 2, fig. 29.

Achnanthes lanceolata Breb. var. *elliptica* Cleve, FR. HUSTEDT, Bacillar. (1930) 208, fig. 306c.

Valve elliptic, obtuse. Length, 0.015 mm; breadth, 0.0085. Striæ 18 in 0.01 mm. An alpine species, reported from Europe.

ACHNANTHES LANCEOLATA Breb. var. ROSTRATA Hustedt. Plate 2, fig. 20; Plate 8, fig. 8; Plate 10, fig. 18.

Achnanthes lanceolata Breb. var. *rostrata* HUSTEDT, Bacillar. (1930) 207–208, fig. 306b.

Valve elliptical with rostrate ends. Length, 0.012 to 0.018 mm; breadth, 0.005 to 0.0068. Upper valve with a lanceolate axial area and on one side with a horseshoe area. Striæ robust, 12 to 18 in 0.01 mm.

ACHNANTHES LANCEOLATA Breb. var. NIPPONICA var. nov. Plate 12, fig. 13.

Valve broad-lanceolate, slightly gibbous in the middle, narrowed towards the ends. Length, 0.015 mm; breadth, 0.006. Upper valve with a lanceolate axial area and with a horseshoe area on one side. Lower valve with a rectangular central area. Striæ 12 in 0.01 mm. Not common.

ACHNANTHES PINNATA Hustedt var. JAPONICA Hustedt. Plate 2, fig. 19; Plate 4, fig. 26.

Achnanthes pinnata Hustedt var. *japonica* HUSTEDT, Bacillar. a. d. Aokikosee in Japan 161, pl. 5, figs. 12–15.

Valve minute, elliptic and obtuse. Length, 0.0051 to 0.006 mm; breadth, 0.0034. Upper valve with very narrow axial area. Striæ 18 in 0.01 mm. Lower valve with indistinct axial area and with a small central area. Reported only from Aokiko Lake, Nippon.

RHOICOSPHENIA CURVATA (Kütz.) Grun.

Rhoicosphenia curvata (Kütz.) Grun., Fr. Hustedt, Bacillar. (1930) 211, fig. 311.

Valve clavate. Length, 0.049 mm; breadth, 0.0025. Common in fresh and brackish water.

AMPHIPLEURA PELLUCIDA Kütz. Plate 3, fig. 3.

Amphipleura pellucida Kütz., Fr. Hustedt, Bacillar. (1930) 218, fig. 321.

Valve lanceolate-attenuate. Length, 0.085 mm; breadth, 0.007. Striæ very fine. Found in fresh and slightly brackish water. Known from Nippon.

AMPHIPLEURA PELLUCIDA Kütz. var. RECTA Kitton. Plate 3, fig. 6.

Amphipleura pellucida Kütz. var. *recta* Kitton, Journ. Quekett Micr. Soc. 2: 21, pl. 4, fig. 4.

Valve linear with gently cuneate ends. Length, 0.2 mm; breadth, 0.013. Striæ 30 in 0.01 mm. According to Kitton variety *recta* is a marine diatom found in Nippon. Reported by me from a mountain stream in southern China (Foochow, Fukien Province).

FRUSTULIA VULGARIS Thwaites. Plate 4, fig. 11.

Frustulia vulgaris Thwaites, Fr. Hustedt, Bacillar. (1930) 221, fig. 327.

Valve linear and obtuse. Length, 0.044 mm; breadth, 0.0085. Striæ very fine. Not common. Reported from Nippon.

FRUSTULIA RHOMBOIDES (Ehr.) de Toni. Plate 4, fig. 19.

Frustulia rhomboides (Ehr.) de Toni, Fr. Hustedt, Bacillar. (1930) 220, fig. 324.

Valve rhombic-lanceolate, attenuate with obtuse ends. Length, 0.17 mm; breadth, 0.03. Central nodule small or elongate. Striæ 24 in 0.01 mm. Common in fresh water.

FRUSTULIA RHOMBOIDES (Ehr.) de Toni var. AMPHIPLEUROIDES Grun. Plate 4, fig. 18.

Frustulia rhomboides (Ehr.) de Toni var. *amphipleuroides* Grun., Fr. Hustedt, Bacillar. (1930) 221, fig. 326.

Valve lanceolate, obtuse. Length, 0.127 mm; breadth, 0.018. Striæ 24 in 0.01 mm. Reported from Aokiko Lake, Nippon.

FRUSTULIA RHOMBOIDES (Ehr.) de Toni var. SAXONICA (Rabh.) de Toni fo. CAPITATA A. Mayer. Plate 4, fig. 12.

Frustulia rhomboides (Ehr.) de Toni var. *saxonica* (Rabh.) de Toni fo. *capitata* A. Mayer, Fr. Hustedt, Bacillar. (1930) 221.

Valve lanceolate with capitate ends. Length, 0.044 mm; breadth, 0.013. Uncommon.

FRUSTULIA RHOMBOIDES (Ehr.) de Toni var. SAXONICA (Rabh.) de Toni fo. UNDULATA Hustedt.

Frustulia rhomboides (Ehr.) de Toni var. *saxonica* (Rabh.) de Toni fo. *undulata* Hustedt, Bacillar. (1930) 221.

Valve slightly triundulate with capitate ends. Length, 0.056 mm; breadth, 0.012. Rare in Kizaki Lake.

GYROSIGMA ACUMINATUM (Kütz.) Rabh. Plate 9, fig. 14.

Gyrosigma acuminatum (Kütz.) Rabh., Fr. Hustedt, Bacillar. (1930) 222–223, fig. 309.

Valve with longitudinal and transverse striæ, 18 in 0.01 mm. Length, 0.136 mm; breadth, 0.02. Common.

GYROSIGMA KUTZINGII (Grun.) Cleve. Plate 3, fig. 7.

Gyrosigma Kützingii (Grun.) Cleve, Fr. Hustedt, Bacillar. (1930) 224, fig. 333.

Valve sigmoid and attenuate. Length, 0.098 mm; breadth, 0.012. Striæ, transversal 18, longitudinal 30, in 0.01 mm. A fresh-water species. Known from Nippon.

GYROSIGMA SCALPROIDES (Rabh.) Cleve. Plate 12, fig. 5.

Gyrosigma scalproides (Rabh.) Cleve, Fr. Hustedt, Bacillar. (1930) 226, fig. 338.

Valve sigmoid with broad ends. Striæ, longitudinal 30, transversal 24, in 0.01 mm. Length, 0.064 mm; breadth, 0.008. Known from Europe, America, and Africa.

CALONEIS SILICULA (Ehr.) Cleve var. TUMIDA Hustedt fo. NIPPONICA fo. nov. Plate 9, fig. 3.

Valve triundulate with broad ends. Length, 0.102 mm; breadth, 0.015. Striæ radiate, 18 in 0.01 mm. Differs from the type in its broad and long ends.

CALONEIS SILICULA (Ehr.) Cleve var. TRUNCATULA Grun. Plate 4, fig. 17.

Caloneis silicula (Ehr.) Cleve var. *truncatula* Grun., Fr. Hustedt, Bacillar. (1930) 238, fig. 363.

Valve slightly undulate in the middle part. Central area a broad fascia. Length, 0.022 mm; breadth, 0.0058. Striæ 24 in 0.01 mm. Common in fresh water.

CALONEIS SILICULA (Ehr.) Cleve var. BAICALENSIS Skvortzow and Meyer. Plate 3, fig. 9.

Caloneis silicula (Ehr.) Cleve var. *baicalensis* SKVORTZOW and MEYER, Contribut. diatoms of Baikal Lake (1928) 12, pl. 1, fig. 44.

Valve linear, triundulate with broad capitate ends. Striæ 24 in 0.01 mm. Central area with a broad stauros. Length, 0.061 mm; breadth, 0.011. Reported from Baikal Lake, Siberia.

NEIDIUM HITCHCOCKII Ehr. Plate 4, fig. 1.

Neidium Hitchcockii Ehr., A. SCHMIDT, Atlas Diatom. pl. 49, figs. 35–36.

Valve elliptic, triundulate with rostrate ends. Length, 0.057 mm; breadth, 0.013. Striæ 18 in 0.01 mm. Common in fresh water.

NEIDIUM PRODUCTUM (W. Smith) Cleve fo. CONSTRICTA Hustedt. Plate 4, fig. 2.

Neidium productum (W. Smith) Cleve fo. *constricta* HUSTEDT, Bacillar. (1930) 246.

Valve constricted with apiculate ends. Length, 0.049 mm; breadth, 0.011. Striæ 24 in 0.01 mm.

NEIDIUM AFFINE (Ehr.) Cleve fo. HERCYNICA (A. Mayer) Hust. Plate 4, fig. 6.

Neidium affine (Ehr.) Cleve fo. *hercynica* (A. Mayer) HUSTEDT, Bacillar. (1930) 243.

Neidium affine var. *genuina* CLEVE, Bacillar. d. Regensburger Gewässer (1913) 109, pl. 10, fig. 33.

Valve lanceolate with obtuse ends. Length, 0.037 mm; breadth, 0.01. Striæ 20 to 24 in 0.01 mm. Known from Europe.

NEIDIUM BISULCATUM (Lagerst.) Cleve var. NIPPONICA var. nov. Plate 3, fig. 1; Plate 4, fig. 8.

Valve linear-lanceolate with slightly attenuate ends. Length, 0.034 to 0.06 mm; breadth, 0.006 to 0.01. Striæ 20 to 30 in 0.01 mm. Differs from the type in its attenuate and acute ends. The type is common in alpine regions.

NEIDIUM DUBIUM (Ehr.) Cleve. Plate 12, fig. 10.

Neidium dubium (Ehr.) Cleve, FR. HUSTEDT, Bacillar. (1930) 246, fig. 385.

Valve broad-lanceolate with acuminate ends. Length, 0.034 mm; breadth, 0.01. Striæ 18 in 0.01 mm. Common in fresh and brackish waters.

NEIDIUM NIPPONICA sp. nov. Plate 8, fig. 1.

Valve large, lanceolate with obtuse ends. Striæ oblique, 18 in 0.01 mm, crossed by longitudinal marginal band. Axial area

narrow, widened on the middle part of each end. Central area broad. Length, 0.142 mm; breadth, 0.025. A distinct species; it resembles *Navicula* sp. figured in A. Schmidt, Atlas Diatom. pl. 49, fig. 1, from Monticello, New York.

NEIDIUM KOZLOWI Meresch. var. NIPPONICA var. nov. Plate 12, fig. 19.

Valve linear with parallel margins and rostrate ends. Striæ oblique, 24 to 28 in 0.01 mm. Axial area narrow. Central area broad. Length, 0.34 mm; breadth, 0.0062. Differs from variety *parva* Meresch. and variety *hankensis* Skv. in its rostrate ends and its size.

NEIDIUM OBLIQUE-STRIATUM A. S. var. NIPPONICA var. nov. Plate 4, figs. 5 and 22.

Valve lanceolate with attenuate ends. Striæ oblique, 16 to 17 in 0.01 mm. Length, 0.096 to 0.1 mm; breadth, 0.02 to 0.025. This new variety resembles *Neidium* sp. in A. Schmidt, Atlas Diatom. pl. 49, fig. 1, and *Neidium affine* var. *amphirhynchus* Ehr. fo. *maxima* Cleve, Navicul. Diatom. 69.

NEIDIUM OBLIQUE-STRIATUM A. S. var. ROSTRATA var. nov. Plate 4, fig. 16.

Valve with rostrate ends. Striæ oblique, 24 in 0.01 mm. Length, 0.061 mm; breadth, 0.015. Differs from the type in its rostrate ends.

NEIDIUM OBLIQUE-STRIATUM A. S. var. APICULATA var. nov. Plate 4, fig. 24.

Valve lanceolate with obtuse and apiculate ends. Length, 0.044 mm; breadth, 0.012. Striæ oblique, 14 in 0.01 mm. Not common.

DIPLONEIS OVALIS (Hilse) Cleve. Plate 2, fig. 37.

Diploneis ovalis (Hilse) Cleve, Fr. Hustedt, Bacillar. (1930) 249, fig. 390.

Valve elliptic with broad and rounded ends. Length, 0.028 to 0.03 mm; breadth, 0.013 to 0.015. Central nodule large, rounded. Transverse rows of alveoli 9 to 10 in 0.01 mm, radiate at ends. Puncta 14 in 0.01 mm. Common in fresh water. Reported from Nippon. According to Fr. Hustedt, the Nippon forms of *Diploneis ovalis* are always large with double rows of alveoli. Such forms I find it desirable to separate.

DIPLONEIS OVALIS (Hilse) Cleve var. OBLONGELLA (Naegeli) Cleve. Plate 2, fig. 26.

Diploneis ovalis (Hilse) Cleve var. *oblongella* (Naegeli) Cleve, Fr. Hustedt, Bacillar. (1930) 249, fig. 391.

Valve linear-elliptic. Length, 0.044 to 0.046 mm; breadth, 0.013 to 0.017. Rows of alveoli 10 to 11 in 0.01 mm. Very common in Kizaki Lake. Known from Aokiko Lake.

DIPLONEIS PUELLA (Schum.) Cleve. Plate 2, fig. 2.

Valve elliptic. Length, 0.023 mm; breadth, 0.012. Central nodule quadrate. Furrows narrow. Costæ 12 to 13 in 0.01 mm. Alveoli indistinct. Known from fresh and brackish waters.

DIPLONEIS MARGINESTRIATA Hustedt. Plate 12, fig. 9.

Diploneis marginestriata HUSTEDT, Bacillar. (1930) 250, fig. 393.

Valve elongate-elliptic with broad ends. Length, 0.032 mm; breadth, 0.01. Central nodule quadrate. Furrow broad, linear. Costæ 21 in 0.01 mm, radiate at the ends. Known from alpine lakes in Europe. Reported from Aokiko Lake, Nippon.

DIPLONEIS SMITHII (Breb.) Cleve var. **NIPPONICA** var. nov. Plate 2, figs. 1 and 9.

Valve elliptic. Length, 0.068 to 0.1 mm; breadth, 0.03 to 0.047. Central nodule quadrate. Terminal nodules distant from the ends. Furrows broad, inclosing a space one-fourth as broad as the valve. Costæ 5 to 6 in 0.01 mm, with double rows of alveoli, forming oblique lines. Differs from the type by its more elongate and attenuate ends. Very common in Kizaki Lake. The typical *Diploneis Smithii* is known as a brackish-water species.

DIPLONEIS SMITHII (Breb.) Cleve var. **OBLONGELLA** var. nov. Plate 9, fig. 1.

Valve elongate-elliptic with broad ends. Length, 0.098 to 0.1 mm; breadth, 0.035 to 0.039. Central nodule quadrate. Furrow broad-lanceolate, inclosing a space one-third as broad as the valve. Costæ 6 in 0.01 mm, with a double row of alveoli. Common in Kizaki Lake.

DIPLONEIS OCULATA (Breb.) Cleve. Plate 2, fig. 4.

Diploneis oculata (Breb.) Cleve, FR. HUSTEDT, Bacillar. (1930) 250, fig. 392.

Valve elongate-elliptic. Length, 0.024 mm; breadth, 0.0076. Central nodule quadrate. Furrows linear. Costæ 24 in 0.01 mm. Reported from Aokiko Lake.

DIPLONEIS OCULATA (Breb.) Cleve var. **NIPPONICA** var. nov. Plate 14, fig. 2.

Valve minute, elliptic with attenuated and rounded ends. Striæ fine, marginal, 18 in 0.01 mm. Length, 0.012 mm; breadth, 0.006. Lateral area hyaline. Central nodule quadrate. Furrow linear, interrupted in the middle part. *Diploneis oculata* is reported from Aokiko Lake.

DIPLONEIS ELLIPTICA (Kütz.) Cleve var. LADOGENSIS Cleve. Plate 2, figs. 3 and 6.

Diploneis elliptica (Kütz.) Cleve var. *ladogensis* CLEVE, Diatom. Finland (1893) 43, pl. 2, fig. 9.

Valve elliptic. Length, 0.027 to 0.035 mm; breadth, 0.015 to 0.023. Transverse costæ irregularly anastomosing with a few, longitudinal, undulating costæ. Known from Europe.

STAURONEIS PHŒNICENTERON Ehr. Plate 5, fig. 19.

Stauroneis phoenicenteron Ehr., FR. HUSTEDT, Bacillar. (1930) 255, fig. 404.

Valve lanceolate, with attenuate ends. Length, 0.15 mm; breadth, 0.028. Striæ 14 in 0.01 mm. Common in fresh water.

STAURONEIS PHŒNICENTERON Ehr. fo. NIPPONICA fo. nov. Plate 3, fig. 21; Plate 9, fig. 4.

Valve lanceolate, broad with acute ends. Striæ radiate and somewhat curved, 14 to 18 in 0.01 mm. Length, 0.085 to 0.11 mm; breadth, 0.024 to 0.025. Differs from the type in its short valve.

STAURONEIS ANCEPS Ehr. Plate 5, fig. 15.

Stauroneis anceps Ehr., FR. HUSTEDT, Bacillar. (1930) 256, fig. 405.

Valve lanceolate with attenuate ends. Striæ 18 in 0.01 mm. Length, 0.049 to 0.085 mm; breadth, 0.011 to 0.02. Common in fresh water.

STAURONEIS ANCEPS Ehr. fo. GRACILIS (Ehr.) Cleve. Plate 5, fig. 20.

Stauroneis anceps Ehr. fo. *gracilis* (Ehr.) Cleve, FR. HUSTEDT, Bacillar. (1930) 256, fig. 406.

Valve with long capitate ends. Length, 0.08 mm; breadth, 0.013. Striæ 15 in 0.01 mm. Rare.

STAURONEIS ANCEPS Ehr. var. LINEARIS (Ehr.) Cleve. Plate 5, fig. 14.

Stauroneis anceps Ehr. var. *linearis* (Ehr.) Cleve, FR. HUSTEDT, Bacillar. (1930) 256, fig. 407.

Valve linear with rostrate ends. Length, 0.045 mm; breadth, 0.0085. Striæ 24 in 0.01 mm. Uncommon.

STAURONEIS SMITHII Grun. Plate 3, fig. 11.

Stauroneis Smithii Grun., FR. HUSTEDT, Bacillar. (1930) 261, fig. 420.

Valve lanceolate, constricted in the middle part, rostrate at the ends. Central area a short fascia. Length, 0.016 mm; breadth, 0.0042. Common in fresh water.

STAURONEIS SMITHII Grun. var. INCISA Pantocsek. Plate 4, fig. 27.

Stauroneis Smithii Grun. var. *incisa* Pantocsek, FR. HUSTEDT, Bacillar. (1930) 261, fig. 421.

Valve lanceolate, attenuate with long ends. Length, 0.04 mm; breadth, 0.008. Striæ 24 in 0.01 mm. Rare.

STAURONEIS SMITHII Grun. var. NIPPONICA var. nov. Plate 10, fig. 23.

Valve slightly triundulate. Ends long, acuminate. Length, 0.034 mm; breadth, 0.0068. Striæ 28 to 30 in 0.01 mm. Differs from variety *incisa* in its undulate margins.

ANOMŒONEIS EXILIS (Kütz.) Cleve var. NIPPONICA var. nov. Plate 11, fig. 12.

Valve sublinear-lanceolate, asymmetrical, convex, with attenuated, obtuse ends. Length, 0.044 mm; breadth, 0.0051. Striæ indistinctly punctuate, striolate, 18 to 20 in 0.01 mm. Not common in Kizaki Lake.

NAVICULA CUSPIDATA Kütz. Plate 6, fig. 16.

Navicula cuspidata Kütz., Fr. Hustedt, Bacillar. (1930) 268, fig. 433.

Valve lanceolate, acute. Striæ parallel, 15 in 0.01 mm. Length, 0.096 mm; breadth, 0.022. Uncommon.

NAVICULA HOLOPHILA (Grun.) Cleve fo. MINOR Kolbe. Plate 4, fig. 13.

Navicula holophila (Grun.) Cleve fo. *minor* Kolbe, Kieselalgen des Sperenberger Salzgebiets (1927) 67, pl. 1, fig. 4.

Valve lanceolate, acute. Striæ fine, slightly radiate; transversal striæ 18, longitudinal 30, in 0.01 mm. Axial area narrow. Length, 0.062 mm; breadth, 0.017. Known from brackish water in Europe.

NAVICULA LAPIDOSA Krasske var. NIPPONICA var. nov. Plate 5, fig. 12.

Valve elliptica. Striæ radiate, 18 to 19 in 0.01 mm. Central area a broad stauros, widened and truncate outwards. Axial area very narrow. Length, 0.015 mm; breadth, 0.0065. *Navicula lapidosa* is known from Europe.

NAVICULA ROTÆANA (Rabh.) Grun. Plate 4, fig. 25.

Navicula Rotæana (Rabh.) Grun., Fr. Hustedt, Bacillar. (1930) 273, fig. 445.

Valve elliptic, rounded. Striæ fine, 20 to 25 in 0.01 mm. Central area a broad stauros. Length, 0.015 mm; breadth, 0.0068. An alpine species.

NAVICULA MUTICA Kütz. Plate 15, fig. 5.

Navicula mutica Kütz., Fr. Hustedt, Bacillar. (1930) 274, fig. 453a.

Valve elliptic-lanceolate. Striæ distinctly punctate, 20 in 0.01 mm. Central area with an isolated punctum. Length, 0.022 mm; breadth, 0.0085. Common in fresh water.

NAVICULA PERPUSILLA Grun. Plate 9, fig. 6.

Navicula perpusilla Grun., FR. HUSTEDT, Bacillar. (1930) 278, fig. 459.

Valve broad-elliptic. Striæ very fine, 30 in 0.01 mm. Axial area broad. Length, 0.01 mm; breadth, 0.0042. Uncommon in Kizaki Lake.

NAVICULA CONFERVACEA Kütz. fo. NIPPONICA fo. nov. Plate 2, fig. 7; Plate 4, fig. 23.

Valve elliptic, attenuate at the ends. Striæ radiate, marginal, 15 to 16 in 0.01 mm. Axial and central areas broad-lanceolate. Length, 0.014 to 0.015 mm; breadth, 0.0068 to 0.007. *Navicula confervacea* is common in the Tropics.

NAVICULA AMERICANA Ehr. Plate 3, fig. 23.

Navicula americana Ehr., FR. HUSTEDT, Bacillar. (1930) 280, fig. 464.

Valve linear, obtuse. Length, 0.088 mm; breadth, 0.02. Striæ 15 in 0.01 mm. Not common in Kizaki Lake.

NAVICULA LAMBDA Cleve var. DENSISTRIATA var. nov. Plate 4, fig. 7.

Valve linear. Striæ in the middle part of the valve 24, in the ends about 30, in 0.01 mm. Length, 0.045 mm; breadth, 0.0085. The Nippon variety differs from the type in its close striæ. *Navicula Lambda* is known from Demerara River, South America.

NAVICULA PUPULA Kütz. Plate 12, fig. 15.

Navicula pupula Kütz. var. *rectangularis* (Greg.) Grun., FR. HUSTEDT, Bacillar. (1930) 281, fig. 467b.

Valve linear. Length, 0.039 mm; breadth, 0.008. Striæ 24 in 0.01 mm. Common.

NAVICULA PUPULA Kütz. var. CAPITATA Hustedt. Plate 4, fig. 10.

Navicula pupula Kütz. var. *capitata* HUSTEDT, Bacillar. (1930) 281, fig. 467c.

Valve with capitate ends. Striæ 14 to 20 in 0.01 mm. Length, 0.013 to 0.028 mm; breadth, 0.004 to 0.006. Not common.

NAVICULA CRUCICULA (W. Smith) Donkin var. CAPITATA var. nov. Plate 5, fig. 11.

Valve elliptic with capitate ends. Striæ closer towards the ends, 15 to 16 in 0.01 mm. Axial area very narrow, somewhat widened in the middle part. Length, 0.02 mm; breadth, 0.006. Differs from the type in its capitate ends.

NAVICULA AQUEDUCTÆ Krasske fo. MINUS Krasske. Plate 5, fig. 10.

Navicula aqueductæ Krasske fo. *minus* KRASSKE, Bacillar. Veget. Niederhessens (1925) 44, pl. 2, fig. 23.

Valve slightly siliceous, linear, constricted in the middle part, attenuate and capitate at the ends. Length, 0.014 mm; breadth, 0.0028. Reported from Europe.

NAVICULA MURALIS Grun. Plate 4, fig. 14.

Navicula muralis Grun., FR. HUSTEDT, Bacillar. (1930) 288, fig. 482.

A minute elliptical valve with rounded ends. Striæ in the middle 28 to 30, at the ends 40, in 0.01 mm. Common in fresh water.

NAVICULA ATOMARIUS sp. nov. Plate 2, fig. 13.

Valve linear, slightly convex and obtuse. Length, 0.009 mm; breadth, 0.0034. Striæ very fine, about 40 in 0.01 mm. Central area round, axial area linear and narrow. Differs from *Navicula pelliculosa* (Breb.) Hilse in its enlarged central area.

NAVICULA ATOMUS (Naegeli) Grun. var. NIPPONICA var. nov. Plate 10, fig. 16.

Valve elliptical. Striæ radiate, in the middle 16, at the ends 20, in 0.01 mm. Length, 0.015 mm; breadth, 0.005. *Navicula atomus* is smaller than the Nippon variety.

NAVICULA MINUSCULA Grun. Plate 11, fig. 11.

Navicula minuscula Grun., FR. HUSTEDT, Bacillar. (1930) 288, fig. 483.

Valve slightly siliceous, lanceolate. Length, 0.01 mm; breadth, 0.003. Common.

NAVICULA PUSIO Cleve. Plate 4, figs. 20 and 21; Plate 11, fig. 22.

Navicula Pusio CLEVE, Synopsis of the Navic. Diatoms (1895) 2, 9, pl. 2, fig. 3.

Valve elliptical, with broad rostrate ends. Axial area very narrow, central area small. Striæ fine, radiate, about 25 to 30 in 0.01 mm, closer towards the ends. Length, 0.014 to 0.018 mm; breadth, 0.006 to 0.008. Reported from Rotorua Lake, New Zealand, and from Aokiko Lake, Nippon.

NAVICULA PUSIO Cleve var. ARCUATA (Pantocsek) Skvortzow. Plate 2, fig. 35.

Navicula arcuata PANTOCSEK, Fossile Bacillarien Ungarns (1903) 3, pl. 6, fig. 97.

Valve larger than the type. Striæ very fine. Axial area narrow, widened in the middle. Length, 0.027 mm; breadth, 0.013. The typical *Navicula arcuata* has radiate striæ.

NAVICULA PSEUDOSCUTIFORMIS Hustedt. Plate 4, fig. 15.

Navicula pseudoscutiformis HUSTEDT, Bacillar. (1930) 291, fig. 495.

Valve broad-elliptical, about circular. Striæ radiate, 18 in 0.01 mm. Length, 0.0085 mm; breadth, 0.007. Known from Europe.

NAVICULA CRYPTOCEPHALA Kütz. Plate 10, fig. 3.

Navicula cryptocephala Kütz., Fr. Hustedt, Bacillar. (1930) 295, fig. 496.

Valve lanceolate, attenuate. Striæ radiate, 18 in 0.01 mm. Length, 0.02 mm; breadth, 0.005. Common in fresh water.

NAVICULA CRYPTOCEPHALA Kütz. var. VENETA (Kütz.) Grun. Plate 7, fig. 14.

Navicula cryptocephala Kütz. var. *veneta* (Kütz.) Grun., Fr. Hustedt, Bacillar. (1930) 295, fig. 497a.

Valve lanceolate, attenuate. Striæ radiate, 13 to 14 in 0.01 mm. Axial area narrow. Length, 0.023 mm; breadth, 0.005. Common in fresh water.

NAVICULA SALINARUM Grun. var. NIPPONICA var. nov. Plate 5, fig. 21.

Valve lanceolate, elliptical and acuminate. Striæ robust, 9 in 0.01 mm, in the middle of unequal length. Length, 0.03 mm; breadth, 0.0085. The typical *Navicula salinarum* has the striæ 14 to 16 in 0.01 mm and is known from brackish water.

NAVICULA RHYNCHOCEPHALA Kütz. Plate 5, fig. 2.

Navicula rhynchocephala Kütz., Fr. Hustedt, Bacillar. (1930) 296, fig. 501.

Valve lanceolate with attenuate ends. Striæ radiate, 12 to 13 in 0.01 mm. Axial area narrow. Length, 0.035 mm; breadth, 0.0085. Reported from many parts of the world.

NAVICULA ROSTELLATA Kütz. Plate 5, fig. 3.

Navicula rostellata Kütz., A. Schmidt, Atlas Diatom. pl. 47, figs. 27–30.

Valve lanceolate with attenuate ends. Striæ radiate in the middle, of unequal length, 11 in 0.01 mm. Length, 0.035 mm; breadth, 0.0076. Known from Nippon.

NAVICULA ROSTELLATA Kütz. var. NIPPONICA var. nov. Plate 5, fig. 22.

Valve more attenuate with slightly capitate ends. Striæ 9 to 10 in 0.01 mm. Length, 0.028 mm; breadth, 0.006. Differs from the type in its margins and capitate ends. Uncommon.

NAVICULA RADIOSA Kütz. Plate 5, fig. 8.

Navicula radiosa Kütz., Fr. Hustedt, Bacillar. (1930) 299, fig. 513.

Valve narrow-lanceolate, acuminate. Striæ 9 in 0.01 mm. Length, 0.072 mm; breadth, 0.01. Common in fresh water.

NAVICULA MENISCULUS Schumann. Plate 5, fig. 16.

Navicula menisculus Schumann, Fr. Hustedt, Bacillar. (1930) 301, fig. 517.

Valve lanceolate, broad. Striæ robust, not lineolate, 9 in 0.01 mm, of unequal length in the middle. Central area broad. Length, 0.045 mm; breadth, 0.013. Common.

NAVICULA GLOBULIFERA Hustedt. Plate 5, fig. 7.

Navicula globulifera HUSTEDT, Bacillar. aus dem Aokikosee in Japan 164, pl. 5, fig. 7.

Valve lanceolate with capitate ends. Striæ divergent in the middle, convergent at the ends. The middle striæ 8 to 9, the end striæ 14, in 0.01 mm. Length, 0.068 mm; breadth, 0.01. Only known from Nippon.

NAVICULA GLOBULIFERA Hustedt var. NIPPONICA var. nov. Plate 3, fig. 10.

Valve more elongate with noncapitate ends. Striæ 12 in 0.01 mm. Length, 0.083 mm; breadth, 0.01. Differs from the type in its attenuate and noncapitate ends.

NAVICULA FALAISIENSIS Grun. var. LANCEOLA Grun. Plate 5, fig. 9.

Navicula falaisiensis Grun. var. *lanceola* Grun., FR. HUSTEDT, Bacillar. (1930) 302, fig. 524.

Valve linear-lanceolate with rounded and truncate ends. Striæ fine, radiate, 18 to 22 in 0.01 mm. Axial area very narrow. Central area small. Length, 0.017 mm; breadth, 0.005. Reported from slightly brackish and fresh waters.

NAVICULA FALAISIENSIS Grun. var. NIPPONICA var. nov. Plate 6, fig. 15.

Valve lanceolate, rostrate. Striæ fine, slightly radiate, 18 in 0.01 mm. Axial area very narrow. Differs from the type in its subrostrate or rostrate ends and different number of striæ.

NAVICULA DICEPHALA (Ehr.) W. Smith. Plate 3, fig. 4.

Navicula dicephala (Ehr.) W. Smith, FR. HUSTEDT, Bacillar. (1930) 302, fig. 526.

Valve linear-lanceolate with rostrate ends. Striæ radiate, 11 in 0.01 mm. Length, 0.032 mm; breadth, 0.012. Common.

NAVICULA EXIGUA (Greg.) O. Mull. Plate 4, fig. 9.

Navicula exigua (Greg.) O. Mull., FR. HUSTEDT, Bacillar. (1930) 305, fig. 538.

Valve linear-lanceolate with capitate ends. Striæ 16 in 0.01 mm. Length, 0.017 mm; breadth, 0.005. A fresh-water diatom.

NAVICULA SIMILIS Krasske. Plate 5, fig. 13.

Navicula similis Krasske, FR. HUSTEDT, Bacillar. (1930) 303, fig. 528.

Valve minute, lanceolate with acute ends. Striæ distinct, 15 in 0.01 mm. Axial and central areas narrow. Length, 0.01 mm; breadth, 0.005. Reported from Europe.

NAVICULA ANGLICA Ralfs. Plate 5, fig. 18.

Navicula anglica Ralfs., FR. HUSTEDT, Bacillar. (1930) 303, figs. 530–531.

Valve elliptic with rostrate ends. Striæ slightly radiate, 12 to 13 in 0.01 mm. Axial area narrow, widened in the middle part. Length, 0.022 mm; breadth, 0.008. Common in fresh water.

NAVICULA PLACENTULA (Ehr.) Grun. fo. ROSTRATA A. Mayer. Plate 5, fig. 5.

Navicula placentula (Ehr.) Grun. fo. *rostrata* A. Mayer, FR. HUSTEDT, Bacillar. (1930) 304, fig. 533.

Valve elliptic-lanceolate with rostrate ends. Striæ robust, 7 in 0.01 mm. Length, 0.062 mm; breadth, 0.023. Reported from Europe, Siberia, New Zealand, and America.

NAVICULA PLACENTULA (Ehr.) Grun. fo. NIPPONICA fo. nov. Plate 10, fig. 20.

Valve robust, short-lanceolate with rostrate ends. Striæ 12 in 0.01 mm. Length, 0.024 mm; breadth, 0.012. This form differs from form *rostrata* Mayer in its shorter valve.

NAVICULA LANCEOLATA (Agardh) Kütz. Plate 5, fig. 4; Plate 10, fig. 5.

Navicula lanceolata (Agardh) Kütz., FR. HUSTEDT, Bacillar. (1930) 305, fig. 540.

Valve lanceolate, acuminate. Striæ lineolate, 9 to 12 in 0.01 mm. Length, 0.059 to 0.06 mm; breadth, 0.0085 to 0.01. Known from Nippon.

NAVICULA LANCEOLATA (Agardh) Kütz. var. CYMBULA (Donk.) Cleve. Plate 5, fig. 17.

Navicula lanceolata (Agardh) Kütz. var. *cymbula* (Donk.) Cleve, VAN HEURCK, Synopsis pl. 7, fig. 32.

Valve lanceolate, acuminate. Striæ radiate, lineate, widened, in the middle 5, at the ends 8, in 0.01 mm. Length, 0.085 mm; breadth, 0.013. Reported from Nippon.

NAVICULA HASTA Pantocsek. Plate 5, fig. 1.

Navicula hasta PANTOCSEK, Fossil. Diatom. Ungarn (1903) 3, pl. 5, fig. 74; pl. 14, fig. 213.

Valve lanceolate with attenuate, not cuneate, rounded ends. Striæ lineate, robust, 7 to 8 in 0.01 mm, radiate, widened in the middle part. Length, 0.096 mm; breadth, 0.017. Our specimens are different from the forms described by Fr. Meister from Nojiri and Suwa Lakes in Nippon.

NAVICULA PEREGRINA (Ehr.) Kütz. var. CUNEATA var. nov. Plate 5, fig. 24.

Valve lanceolate, broad with cuneate ends. Striæ radiate divergent at the ends, 9 in 0.01 mm. Length, 0.049 mm;

breadth, 0.0085. Differs from the type in its broad valve and its ends.

NAVICULA LACUSTRIS Greg. Plate 5, fig. 6; Plate 8, fig. 9.

Navicula lacustris Greg., CLEVE, Diatoms Finland (1893) 34, pl. 2, figs. 3, 12, 14.

Valve elliptical and acuminate. Striæ punctate. Length, 0.02 to 0.044 mm; breadth, 0.01 to 0.015. Striæ 16 in 0.01 mm. Reported from Europe, Asia, and America.

NAVICULA AMPHIBOLA Cleve. Plate 9, fig. 20.

Navicula amphibola Cleve, FR. HUSTEDT, Bacillar. (1930) 309–310, fig. 554.

Valve lanceolate with attenuate ends. Striæ punctate, 12 in 0.01 mm. Length, 0.047 mm; breadth, 0.017. Not common in Kizaki Lake.

NAVICULA PALEA sp. nov. Plate 8, fig. 4.

Valve linear, lanceolate, narrow-attenuate with slightly capitate ends. Striæ fine, radiate, 15 to 16 in 0.01 mm. Axial and central areas narrow and linear. Length, 0.029 mm; breadth, 0.0037. Differs from *Navicula radiosa, N. cari,* and *N. cincta* in its narrow central area and capitate ends.

NAVICULA KIZAKENSIS sp. nov. Plate 16, fig. 12.

Valve minute, lanceolate, rounded in the middle, attenuate and capitate at the ends. Striæ radiate, about 30 in 0.01 mm. Axial area narrow, linear, widened in the middle part. Length, 0.011 mm; breadth, 0.0042. Differs from *Navicula Schadei* Krasske [1] in its narrow central area and coarser striæ.

NAVICULA BREHMI Hustedt fo. ELONGATA fo. nov. Plate 3, fig. 2.

Valve linear-elliptic with parallel margins and cuneate ends. Striæ parallel, coarse, 18 to 20 in 0.01 mm. Axial area narrow, linear, widened in the middle part. Length, 0.032 mm; breadth, 0.0068. Differs from the type in its longer valves. The type is reported from Aokiko Lake, Nippon.

PINNULARIA LEPTOSOMA Grun. Plate 9, fig. 8.

Pinnularia leptosoma Grun., FR. HUSTEDT, Bacillar. (1930) 316, fig. 567.

Valve linear, narrowed towards the ends. Striæ radiate, 15 in 0.01 mm. Length, 0.032 mm; breadth, 0.005. A freshwater species, especially of alpine regions.

[1] Beiträge zur Kenntniss der Diatomeenflora Sachsens (1929) 355, fig. 11a, b.

PINNULARIA LEPTOSOMA Grun. var. NIPPONICA var. nov. Plate 8, fig. 15.

Valve linear, attenuate. Striæ fine, 14 in 0.01 mm. Axial area narrow, central area a broad fascia. Length, 0.066 mm; breadth, 0.0068. Differs from the type in its longer valves.

PINNULARIA MOLARIS Grun. Plate 6, fig. 13.

Pinnularia molaris Grun., FR. HUSTEDT, Bacillar. (1930) 316, fig. 568.

Valve minute, lanceolate, with radiate striæ 18 in 0.01 mm. Length, 0.025 mm; breadth, 0.005. Common in fresh water.

PINNULARIA MESOLEPTA (Ehr.) W. Smith. Plate 3, fig. 19; Plate 12, fig. 11.

Pinnularia mesolepta (Ehr.) W. Smith., FR. HUSTEDT, Bacillar. (1930) 319, fig. 575.

Valve triundulate with capitate ends. Striæ radiate, 10 to 12 in 0.01 mm. Length, 0.022 mm; breadth, 0.006 to 0.012. Common.

PINNULARIA DIVERGENTISSIMA Grun. Plate 12, fig. 24.

Pinnularia divergentissima Grun., VAN HEURCK, Synopsis (1880–1881) pl. 6, fig. 32.

Valve linear, attenuate towards the ends. Striæ strong, radiate, 15 in 0.01 mm, with a broad fascia. Length, 0.047 mm; breadth, 0.0068. Uncommon.

PINNULARIA MICROSTAURON (Ehr.) Cleve. Plate 7, fig. 6.

Pinnularia microstauron (Ehr.) Cleve, FR. HUSTEDT, Bacillar. (1930) 320, fig. 582.

Valve linear-lanceolate with parallel margins and rounded subrostrate ends. Striæ radiate, 10 in 0.01 mm. Length, 0.056 mm; breadth, 0.01. Common.

PINNULARIA MICROSTAURON (Ehr.) Cleve var. AMBIGUA Meister fo. DIMINUTA Grun. Plate 7, fig. 18.

Pinnularia microstauron (Ehr.) Cleve var. *ambigua* Meister fo. *diminuta* Grun., FR. HUSTEDT, Bacillar. (1930) 321–322, fig. 585.

Valve lanceolate. Striæ radiate, 14 in 0.01 mm. Length, 0.03 mm; breadth, 0.006. Common in fresh water.

PINNULARIA MICROSTAURON (Ehr.) Cleve var. NIPPONICA var. nov. Plate 6, fig. 8; Plate 9, fig. 10.

Valve undulate with obtuse ends. Striæ 10 to 11 in 0.01 mm. Length, 0.045 to 0.056 mm; breadth, 0.0085 to 0.011. Differs from the type in its broad obtuse ends.

PINNULARIA MICROSTAURON (Ehr.) Cleve var. KIZAKENSIS var. nov. Plate 6, fig. 7.

Valve with parallel margins and attenuate ends. Striæ robust, 9 to 13 in 0.01 mm. Central area a broad fascia. Length,

0.034 to 0.062 mm; breadth, 0.0083 to 0.013. Differs from the type in its attenuate ends. Common in Kizaki Lake.

PINNULARIA KARELICA Cleve var. JAPONICA Hustedt. Plate 6, fig. 4.

Pinnularia karelica Cleve var. *japonica* HUSTEDT, Bacillar. d. Aoki-kosee in Japan 165, pl. 5, fig. 3.

A distinct form with slightly capitate ends. Striæ 14 in 0.01 mm, crossed by a band. Length, 0.061 mm; breadth, 0.012. Known from Aokiko Lake.

PINNULARIA KARELICA Cleve var. JAPONICA Hustedt fo. OBTUSA fo. nov. Plate 6, fig. 3.

A small obtuse form, with striæ 12 to 13 in 0.01 mm, with narrow axial area. Length, 0.044 mm; breadth, 0.013. Uncommon.

PINNULARIA KARELICA Cleve var. INSULARIS var. nov. Plate 6, fig. 12.

Valve linear with capitate ends. Striæ 8 to 9 in 0.01 mm, crossed by a narrow band. Central area elliptical. Differs from variety *japonica* Hustedt in its broad axial area and larger valve.

PINNULARIA LEGUMEN Ehr. Plate 8, fig. 6.

Pinnularia legumen Ehr., FR. HUSTEDT, Bacillar. (1930) 322, fig. 587.

Valve strongly triundulate with capitate ends. Striæ 8 in 0.01 mm. Length, 0.088 mm; breadth, 0.014. Reported from Nippon.

PINNULARIA LEGUMEN Ehr. var. NIPPONICA var. nov. Plate 7, fig. 4.

Valve with slightly undulate margins. Striæ 10 in 0.01 mm. Length, 0.078 mm; breadth, 0.015. Differs from the type in its broader and more obtuse valve.

PINNULARIA PLATYCEPHALA (Ehr.) Cleve. Plate 6, fig. 1.

Pinnularia platycephala (Ehr.) Cleve, FR. HUSTEDT, Bacillar. (1930) 324, fig. 593.

A robust species with triundulate margins. Striæ divergent in the middle, convergent at the ends, 8 in 0.01 mm. Length, 0.09 mm; breadth, 0.019. Common in lakes.

PINNULARIA PLATYCEPHALA (Ehr.) Cleve var. HATTORIANA Meister. Plate 6, fig. 2.

Pinnularia platycephala (Ehr.) Cleve var. *Hattoriana* MEISTER, Beiträge zur Bacillar. Japans (1914) 2, 228–229, pl. 8, figs. 6, 7.

A distinct diatom with capitate ends and large comma-shaped terminal fissures. Length, 0.079 mm; breadth, 0.01. Striæ 8 in 0.01 mm. This diatom was named by Dr. Fr. Meister in

honor of D. Hattori, of the Botanical Institute, Imperial University, Tokyo.

PINNULARIA MONTANA Hustedt fo. MINOR fo. nov. Plate 9, fig. 9.

Valve lanceolate. Striæ short, 8 to 9 in 0.01 mm. Length, 0.051 to 0.068 mm; breadth, 0.012 to 0.015. Longitudinal band indistinct. The typical *Pinnularia montana* was described from Aokiko Lake and is twice as large (length, 0.12 to 0.15 mm).

PINNULARIA BREVICOSTATA Cleve. Plate 12, fig. 1.

Pinnularia montana Hustedt var. *sinica* SKVORTZOW, Alpine diatoms of South China (1929) 43, pl. 2, fig. 14; pl. 3, fig. 13.

Valve linear with obtuse ends. Striæ parallel, with a longitudinal band, 10 to 11 in 0.01 mm. Length, 0.105 mm; breadth, 0.017. Reported from Foochow, southern China.

PINNULARIA GIBBA Ehr. Plate 7, figs. 2 and 3.

Pinnularia gibba Ehr., FR. HUSTEDT, Bacillar. (1930) 327, fig. 600a, b.

Valve lanceolate with capitate ends. Central area a broad fascia. Length, 0.066 to 0.068 mm; breadth, 0.008 to 0.01. Striæ 9 to 11 in 0.01 mm. Common in fresh water.

PINNULARIA GIBBA Ehr. fo. SUBUNDULATA Mayer. Plate 7, fig. 15.

Pinnularia gibba Ehr. fo. *subundulata* Mayer, FR. HUSTEDT, Bacillar. (1930) 327, fig. 601.

Valve slightly triundulate with rostrate, minutely capitate ends. Striæ divergent in the middle, convergent at the ends, 8 in 0.01 mm. Length, 0.069 mm; breadth, 0.01. Common.

PINNULARIA GIBBA Ehr. var. NIPPONICA var. nov. Plate 7, fig. 10.

Valve slightly triundulate, ends little capitate. Striæ radiate, 12 in 0.01 mm. Central area round. Length, 0.095 mm; breadth, 0.013. Differs from the type in its triundulate margins.

PINNULARIA OKAMURÆ sp. nov. Plate 7, fig. 13.

Valve linear with attenuate ends. Striæ divergent in the middle part, convergent at the ends, 11 to 12 in 0.01 mm. Length, 0.061 mm; breadth, 0.008. A species related to *Pinnularia gibba* var. *linearis* Hustedt. Named in honor of the late Prof. Dr. K. Okamura, director of the Imperial Fisheries Institute, Tokyo.

PINNULARIA BOREALIS Ehr. Plate 7, fig. 17; Plate 16, fig. 15.

Pinnularia borealis Ehr., FR. HUSTEDT, Bacillar. (1930) 326, fig. 597.

Valve linear-elliptic with rounded ends. Striæ radiate, 5 to 7 in 0.01 mm. Length, 0.027 mm; breadth, 0.0068 to 0.009. Com-

mon on mosses, moist earth, and in fresh water. Known from Nippon.

PINNULARIA BALFOURIANA Grun. var. STAUROPTERA var. nov. Plate 16, fig. 14.

A minute form with radiate striæ, 9 to 10 in 0.01 mm, which form a stauros in the middle part of the valve. Length, 0.017 mm; breadth, 0.005. Rare. Differs from the type in its larger size and a stauros in the middle part of the valve.

PINNULARIA LIGNITICA Cleve. Plate 10, fig. 26.

Pinnularia lignitica CLEVE, Synopsis Navicul. Diatoms (1895) 2, 85, pl. 1, fig. 15.

A distinct species with rhombic valve, short striæ 11 to 12 in 0.01 mm, and a broad central area. Length, 0.062 mm; breadth, 0.018. Longitudinal band distinct. Common in Kizaki Lake. Reported as a fossil from Nippon lignite (Brun collections).

PINNULARIA TABELLARIA Ehr. Plate 9, fig. 5.

Pinnularia tabellaria Ehr., A. SCHMIDT, Atlas Diatom. pl. 43, fig. 4.

Valve linear, slightly gibbous in the middle. Striæ parallel, convergent at the ends, 10 in 0.01 mm. Axial area linear, central area elliptic. Length, 0.244 mm; breadth, 0.019. Known from North America, Brazil, Siberia, and South Africa.

PINNULARIA HUSTEDTII Meister. Plate 8, fig. 5.

Pinnulara Hustedtii MEISTER, Seltene und neue Kieselalgen (1934) 102, fig. 82.

Valve linear with capitate ends. Axial area linear, widened in the middle. Striæ 9 in 0.01 mm. Length, 0.221 mm; breadth, 0.017. Reported only from Canton River, southern China.

PINNULARIA MAJOR (Kütz.) Cleve. Plate 6, fig. 10.

Pinnularia major (Kütz.) Cleve, FR. HUSTEDT, Bacillar. (1930) 331, 614.

Valve linear, slightly gibbous in the middle. Length, 0.161 mm; breadth, 0.022. Striæ 7 in 0.01 mm. Common in fresh water. Known from Nippon.

PINNULARIA MAJOR (Kütz.) Cleve var. LINEARIS Cleve. Plate 7, fig. 11.

Pinnularia major (Kütz.) Cleve var. *linearis* Cleve, PANTOCSEK, Fossile Bacillarien Ungarns (1905) 3, pl. 7, fig. 113.

Valve broad-linear with parallel margins. Striæ 9 in 0.01 mm. Length, 0.127 mm; breadth, 0.02. Common.

PINNULARIA VIRIDIS (Nitzsch) Ehr. var. LEPTOGONGYLA (Ehr. Grun.) Cleve. Plate 6, fig. 11.

Pinnularia leptogongyla A. SCHMIDT, Atlas Diatom. (1876) pl. 45, figs. 26–28.

Valve linear with attenuate ends. Striæ 7 to 8.5 in 0.01 mm, with a distinct band. Central area broad, axial area one-third of the breadth of the valve. Known from brackish waters of Europe.

PINNULARIA VIRIDIS (Nitzsch) Ehr. var. INTERMEDIA Cleve. Plate 7, fig. 9.

Pinnularia sp. A. SCHMIDT, Atlas Diatom. (1876) pl. 42, figs. 9–10.

Valve large with two longitudinal bands. Central area broad. Length, 0.105 mm; breadth, 0.017. Striæ 8 to 9 in 0.01 mm. Common in fresh water.

PINNULARIA VIRIDIS (Nitzsch) Ehr. var. FALLAX Cleve. Plate 9, fig. 7; Plate 12, fig. 18.

Navicula sp. A. SCHMIDT, Atlas Diatom. (1876) pl. 43, fig. 24; pl. 45, figs. 10–11.

Valve linear, narrowed towards the ends. Striæ 9 to 11 in 0.01 mm, without longitudinal band. Central area with a short stauros or shortened striæ. Length, 0.045 to 0.049 mm; breadth, 0.01. Common.

PINNULARIA VIRIDIS (Nitzsch) Ehr. var. SUDETICA (Hilse) Hustedt. Plate 9, fig. 21.

Pinnularia viridis (Nitzsch) Ehr. var. *sudetica* (Hilse) HUSTEDT, Bacillar. (1930) 335, fig. 617b.

A form with coarse striæ, 9 in 0.01 mm, with a longitudinal band. Axial and central areas linear. Known from fresh water in Europe.

PINNULARIA VIRIDIS (Nitzsch) Ehr. var. NIPPONICA var. nov. Plate 6, fig. 14; Plate 8, fig. 2.

Valve lanceolate with complex median line. Striæ 6 to 7.5 in 0.01 mm. Length, 0.081 to 0.09 mm; breadth, 0.018. This new variety differs from the type in its striæ without the longitudinal band. Common in Kizaki Lake.

PINNULARIA UENO sp. nov. Plate 7, fig. 1.

Valve boat-shaped, elliptic-lanceolate with parallel margins and obtuse, subrostrate ends. Striæ robust, radiate, dilated in the middle to a transverse fascia, 9 in 0.01 mm. Median line slightly arcuate. Terminal fissures comma-shaped. Axial area somewhat dilated in the middle. Central pores distinct. Length, 0.062 mm; breadth, 0.013. Named in honor of Dr. Masujo Ueno, of Otsu, Nippon.

PINNULARIA NIPPONICA sp. nov. Plate 7, fig. 12.

Valve slightly triundulate, with truncate ends. Striæ robust, radiate, 8 in 0.01 mm. Central area a fascia. Median line flexuose. Terminal fissures comma-shaped. Axial areas linear. Length, 0.072 mm; breadth, 0.013. Uncommon.

PINNULARIA DACTYLUS Ehr. var. DARIANA A. S. fo. NIPPONICA fo. nov. Plate 7, fig. 5.

Valve lanceolate with obtuse ends. Length, 0.122 mm; breadth, 0.22. Median line not complex. Axial area broad, widened in the middle part. Striæ divergent in the middle, convergent at the ends, 8 in 0.01 mm. The type form has the valve 0.18 to 0.21 mm in length with striæ, crossed by a broad band. Variety *Dariana* is reported from America.

PINNULARIA NOBILIS Ehr. Plate 10, fig. 1.

Pinnularia nobilis Ehr., Fr. Hustedt, Bacillar. (1930) 337, fig. 619.

Valve linear, slightly gibbous in the middle, with rounded ends. Length, 0.204 mm; breadth, 0.03. Striæ 6 in 0.01 mm. Common.

PINNULARIA HARTLEYANA Greville. Plate 6, fig. 5.

Pinnularia Hartleyana Greville, Descriptions of new and rare diatoms, T. M. S. 13 (1865) pl. 6, fig. 30; A. Schmidt, Atlas Diatom. (1913) pl. 33, figs. 1, 2; G. B. De Toni and E. L. Forti, Alghe di Australia, Tasmania e Nuova Zelanda (1923) 145, fig. 6.

Valve robust, undulate in the middle and on the ends. Length, 0.12 mm; breadth, 0.015. Ends cuneate. Striæ divergent in the middle, convergent at the ends, 9 in 0.01 mm. Central area a rectangular fascia. Axial area enlarged around the central nodule and expanded at the ends. The Nippon form is smaller than the type. *Pinnularia Hartleyana* has been reported from Liberia and Kalahari in Africa, Demerara River in South America, Wakarevareva in New Zealand, and Aokiko Lake in Nippon.

AMPHORA OVALIS Kütz. fo. GRACILIS (Ehr.) Cleve. Plate 3, fig. 16.

Amphora sp. A. Schmidt, Atlas Diatom. (1875) pl. 26, fig. 101.

Frustule elliptic. Length, 0.02 mm; breadth, 0.0085. Striæ 16 in 0.01 mm. Common in fresh water.

AMPHORA OVALIS Kütz. var. PEDICULUS Kütz. Plate 3, fig. 14.

Amphora ovalis Kütz. var. *pediculus* Kütz., Fr. Hustedt, Bacillar. (1930) 343, fig. 629.

Frustule elliptic. Valve lunate. Length, 0.012 mm; breadth, 0.0076. Striæ 18 in 0.01 mm. Common in fresh and brackish waters. Known from Nippon.

AMPHORA OVALIS Kütz. var. LIBYCA (Ehr.) Cleve. Plate 3, fig. 17.

Amphora libyca Ehr. A. SCHMIDT, Atlas Diatom. (1875) pl. 26, fig. 105.

Valve lunate. Length, 0.035 mm; breadth, 0.0068. Striæ 14 in 0.01 mm. Median line arcuate. Central area distinct, on the dorsal side frequently uniting with a blank band across the striæ. Common in fresh and brackish waters.

AMPHORA PERPUSILLA Grun. Plate 3, fig. 13.

Amphora perpusilla Grun., FR. HUSTEDT, Bacillar. (1930) 343, fig. 627.

Frustule elliptic. Length, 0.005 mm; breadth, 0.0025. Common in fresh water and moist earth.

AMPHORA NORMANII Rabh. Plate 3, fig. 18.

Amphora Normanii Rabh., FR. HUSTEDT, Bacillar. (1930) 343, fig. 630.

Frustule elliptic, truncate. Valve narrow, lunate, and capitate. Central nodule strong. Length, 0.024 mm; breadth, 0.0034. Striæ 18 to 20 in 0.01 mm. Common in moist earth.

AMPHORA DELPHINEA (Bailey) A. S. var. MINOR Cleve. Plate 3, fig. 12.

Amphora delphinea Bailey, A. SCHMIDT, Atlas Diatom. (1876) pl. 40, fig. 25.

Frustule elliptic-rectangular, with parallel margins. Length, 0.047 to 0.05 mm; breadth, 0.015. Valve linear with rounded ends. Central nodule dilated to a stauros. Median line arcuate. Striæ almost parallel, 24 in 0.01 mm. Known from Crane Pond, North America, and from Demerara River, South America. Common in Kizaki Lake.

CYMBELLA MICROCEPHALA Grun. Plate 11, fig. 25.

Cymbella microcephala Grun., FR. HUSTEDT, Bacillar. (1930) 351, fig. 637.

Valve linear with rostrate-capitate ends. Length, 0.017 mm; breadth, 0.0034. Striæ very fine, 28 in 0.01 mm. Common in fresh water.

CYMBELLA ALPINA Grun. Plate 12, fig. 12.

Cymbella alpina Grun., A. SCHMIDT, Atlas Diatom. (1931) pl. 373, fig. 17.

Valve slightly asymmetrical, lanceolate. Length, 0.049 mm; breadth, 0.01. Striæ 8 in 0.01 mm. Common in alpine regions.

CYMBELLA REINHARDTII Grun. Plate 10, fig. 14.

Cymbella Reinhardtii Grun., FR. HUSTEDT, Bacillar. (1930) 354, fig. 644.

Valve slightly asymmetrical, elliptic-lanceolate, with convex dorsal and ventral margins. Axial and central areas broad.

Length, 0.032 mm; breadth, 0.009. Striæ 15 in 0.01 mm. Known from Europe.

CYMBELLA EHRENBERGII Kütz. Plate 11, fig. 3.

Cymbella Ehrenbergii Kütz., Fr. Hustedt, Bacillar. (1930) 356, fig. 656.

Valve elliptic-lanceolate. Length, 0.105 mm; breadth, 0.037. Striæ 9 in 0.01 mm. Common in fresh water.

CYMBELLA NAVICULIFORMIS Auerswald. Plate 11, fig. 6.

Cymbella naviculiformis Auerswald, Fr. Hustedt, Bacillar. (1930) 356–357, fig. 653.

Valve naviculiform, lanceolate with capitate and constricted ends. Length, 0.032 mm; breadth, 0.0085. Striæ 12 in 0.01 mm. Central area circular. Common in Kizaki Lake. Known from alpine regions.

CYMBELLA CUSPIDATA Kütz. Plate 11, fig. 23.

Cymbella cuspidata Kütz., A. Schmidt, Atlas Diatom. (1931) pl. 374, figs. 13, 14.

Valve slightly asymmetrical with rostrate-capitate ends. Length, 0.034 to 0.074 mm; breadth, 0.012 to 0.02. Striæ 8 in 0.01 mm. Known from Nippon.

CYMBELLA HETEROPLEURA Ehr. var. MINOR Cleve. Plate 11, fig. 4.

Cymbella sp. A. Schmidt, Atlas Diatom. (1875) pl. 9, figs. 51, 52.

Valve slightly asymmetrical, lanceolate with rostrate ends. Length, 0.074 mm; breadth, 0.022. Central area large. Striæ 8 in 0.01 mm. Known from fresh waters of far-northern regions.

CYMBELLA HETEROPLEURA Ehr. fo. NIPPONICA fo. nov. Plate 11, fig. 13.

Valve linear-lanceolate, attenuate, and with truncate ends. Length, 0.04 mm; breadth, 0.01. Striæ 8 to 9 in 0.01 mm, not lineate. Axial area linear, central area orbicular. Differs from the type in its small valve.

CYMBELLA PROSTRATA (Berkeley) Cleve. Plate 10, fig. 33.

Cymbella prostrata (Berkeley) Cleve, Fr. Hustedt, Bacillar. (1930) 357–358, fig. 659.

Valve asymmetrical with elevated dorsal and triundulate ventral margins. Median line arcuate with long terminal fissures. Axial area lanceolate. Striæ punctate, 7 ventral, 6 dorsal, in 0.01 mm. Common in fresh and brackish waters.

CYMBELLA TURGIDA (Greg.) Cleve. Plate 11, fig. 20.

Cymbella turgida (Greg.) Cleve, FR. HUSTEDT, Bacillar. (1930) 358, fig. 660.

Valve lunate, with arcuate dorsal margin, slightly gibbous ventral margin. Length, 0.054 mm; breadth, 0.014. Striæ 6 in 0.01 mm. Known from Aokiko Lake. Common in tropical regions.

CYMBELLA VENTRICOSA Kütz. Plate 11, figs. 8, 14, and 18.

Cymbella ventricosa Kütz., FR. HUSTEDT, Bacillar. (1930) 359, fig. 661.

Valve lunate with straight or slightly gibbous ventral margin. Length, 0.025 to 0.032 mm; breadth, 0.006 to 0.007. Striæ 10 to 12 in 0.01 mm. Very common in fresh water.

CYMBELLA GRACILIS Rabh. Plate 11, fig. 5.

Cymbella gracilis Rabh., VAN HEURCK, Synopsis (1880–1881) pl. 3, figs. 20–21.

Valve narrow with slightly arcuate dorsal, and straight ventral, margins. Length, 0.062 mm; breadth, 0.008. Striæ 12 in 0.01 mm. Found in fresh water, especially in alpine regions.

CYMBELLA GRACILIS (Rabh.) Cleve fo. MINOR fo. nov. Plate 12, fig. 22.

Like the type, but smaller. Length, 0.018 mm; breadth, 0.045. Striæ 12 in 0.01 mm. Median line approximate to the ventral margin. Uncommon.

CYMBELLA ÆQUALIS W. Smith. Plate 3, fig. 5; Plate 11, fig. 2.

Cymbella obtusa Greg., A. SCHMIDT, Atlas Diatom. (1875) pl. 9, figs. 41–45.

Valve naviculiform and subclavate. Length, 0.032 to 0.042 mm; breadth, 0.0065 to 0.009. Striæ radiate, 12 to 15 in 0.01 mm. Common in alpine regions. Known from Aokiko Lake.

CYMBELLA SINUATA Greg. Plate 11, fig. 15.

Cymbella sinuata Greg., FR. HUSTEDT, Bacillar. (1930) 361, fig. 668a.

Valve linear, slightly asymmetrical, gibbous in the middle with obtuse ends. Length, 0.02 mm; breadth, 0.005. Striæ 12 in 0.01 mm. Reported from Aokiko Lake.

CYMBELLA SINUATA Greg. var. ANTIQUA Grun. Plate 9, fig. 17.

Cymbella sinuata Greg. var. *antiqua* Grun., PANTOCSEK, Fossile Bacillar. Ungarns (1905) 141, pl. 29, fig. 31.

Valve linear with capitate ends. Length, 0.018 mm; breadth, 0.0068. Striæ 5 to 6 in 0.01 mm. The typical variety *antiqua* is larger, being 0.032 to 0.033 mm in length. Known only as a fossil from Hungary.

CYMBELLA TURGIDULA Grun. Plate 11, fig. 24.

Cymbella turgidula Grun., A. SCHMIDT, Atlas Diatom. (1875) pl. 9, figs. 23–26.

Valve asymmetrical with rostrate and obtuse ends. Length, 0.029 mm; breadth, 0.011. Striæ 9 to 10 in 0.01 mm. On the ventral side of the central nodule are two puncta. Known from the Tropics.

CYMBELLA AFFINIS Kütz. Plate 11, figs. 9 and 10.

Cymbella affinis Kütz., FR. HUSTEDT, Bacillar. (1930) 362, fig. 671.

Valve cymbiform with truncate ends. Length, 0.035 to 0.039 mm; breadth, 0.0085 to 0.012. Striæ 8 to 10 in 0.01 mm. Known from Nippon.

CYMBELLA HYBRIDA Grun. Plate 5, fig. 23.

Cymbella hybrida Grun., CLEVE, Synopsis Navicul. Diatoms (1894) 1, 166, pl. 4, fig. 23.

Navicula rhynchocephala Kütz. var. *hankensis* SKVORTZOW, Diatoms Hanka Lake (1929) 49, pl. 4, fig. 22.

Valve naviculiform, linear with parallel margins and truncate ends. Striæ lineolate, divergent in the middle, convergent at the ends, 9 in 0.01 mm. The median striæ, opposite the stigma, shortened. Axial area narrow, linear widened in the middle. Length, 0.068 mm; breadth, 0.0085. Known from fresh water and very slightly brackish water in Sweden, reported from Hanka Lake, Siberia. Common in Kizaki Lake.

CYMBELLA JAPONICA Reichelt. Plate 10, fig. 4; Plate 11, figs. 1 and 7.

Cymbella japonica Reichelt, A. SCHMIDT, Atlas Diatom. (1931) pl. 373, figs. 29–31.

Cymbella signata Pant. var. *chinensis* SKVORTZOW, Alpine diatoms from South China (1929) 46, pl. 2, fig. 21.

Valve sublinear, subclavate with attenuate, rounded ends. Length, 0.042 to 0.08 mm; breadth, 0.012 to 0.014. Striæ robust, slightly radiate, 6.5 to 8 in 0.01 mm, distinctly lineolate. Median line arcuate, broad with reflexed terminal fissures. Near the central nodule one stigma. Known from Yokohama on mosses, in Aokiko Lake, and common in Kizaki Lake. Reported from a mountain stream near Foochow, southern China.

CYMBELLA CYMBIFORMIS (Agardh, Kütz.) Van Heurck. Plate 11, fig. 21.

Cymbella cymbiformis (Agardh, Kütz.) Van Heurck, FR. HUSTEDT, Bacillar. (1930) 362, fig. 672.

Valve boat-shaped, with slightly gibbous ventral margin and obtuse, truncate ends. Length, 0.051 to 0.076 mm; breadth,

0.0085 to 0.015. Striæ 7 to 10 in 0.01 mm. At the ventral side of the central nodule a distinct isolated punctum. Common in fresh water. Known from Nippon.

CYMBELLA CISTULA (Hemprich) Grun. Plate 3, fig. 20.

Cymbella cistula (Hemp.) Grun., VAN HEURCK, Synopsis (1880–1881) pl. 2, fig. 2.

Valve cymbiform. Length, 0.059 to 0.093 mm; breadth, 0.013 to 0.017. On ventral side one or two isolated puncta. Common in fresh water.

CYMBELLA ASPERA (Ehr.) Cleve var. TRUNCATA (Rabh.) Dippel. Plate 9, fig. 19.

Cymbella gastroides var. *truncata* (Rabh.) Dippel, A. MAYER, Die Bacillar. d. Regensburger Gewässer (1913) 262, pl. 13, fig. 20.

Valve cymbiform with truncate ends. Length, 0.13 mm; breadth, 0.025. Striæ 8 in 0.01 mm. Common.

CYMBELLA TUMIDA (Breb.) Van Heurck. Plate 11, fig. 17.

Cymbella tumida (Breb.) Van Heurck, FR. HUSTEDT, Bacillar. (1930) 366, fig. 677.

Valve boat-shaped with rostrate-truncate ends. Length, 0.057 mm; breadth, 0.017. Striæ 9 in 0.01 mm. Reported from Nippon.

CYMBELLA TUMIDA (Breb.) Van Heurck var. BOREALIS Grun. Plate 11, fig. 16.

Cymbella tumida (Breb.) Van Heurck var. *borealis* Grun., SKVORTZOW, Diatoms of Hanka Lake (1929) pl. 7, fig. 3.

Valve cymbiform and truncate. Length, 0.085 mm; breadth, 0.017. Striæ 8 in 0.01 mm. Common in fresh water.

CYMBELLA KAWAMURÆ sp. nov. Plate 15, fig. 10.

Valve naviculiform, lanceolate, with attenuate and capitate ends. Striæ strong, radiate, not striate, in the middle of unequal length, 12 in 0.01 mm. Axial area very narrow, central elliptical with two isolated puncta. Length, 0.027 mm; breadth, 0.009. A distinct species, named in honor of Prof. Dr. T. Kawamura, of Kyoto, Nippon.

GOMPHONEMA VASTUM Hustedt. Plate 13, fig. 5.

Gomphonema vastum HUSTEDT, Bacillar. a. d. Aokikosee in Japan 166, pl. 5, fig. 4.

Valve clavate with slightly capitate apex and narrow base. Length, 0.028 mm; breadth, 0.006. Striæ short, marginal, 12 in 0.01 mm. Axial area broad. Central area with one isolated punctum. Reported only from Aokiko Lake, Nippon.

GOMPHONEMA VASTUM Hustedt var. CUNEATA var. nov. Plate 10, fig. 11.

Valve with cuneate apex. Length, 0.039 mm; breadth, 0.005. Striæ 15 in 0.01 mm.

GOMPHONEMA VASTUM Hustedt var. ELONGATA var. nov. Plate 13, figs. 33 and 40.

Valve with elongate apex. Length, 0.028 to 0.034 mm; breadth, 0.005 to 0.006. Striæ 12 to 17 in 0.01 mm. Common in Kizaki Lake.

GOMPHONEMA ACUMINATUM Ehr. Plate 13, fig. 38.

Gomphonema acuminatum Ehr., FR. HUSTEDT, Bacillar. (1930) 370, fig. 683.

Valve clavate and biconstricted. Striæ 10 to 11 in 0.01 mm. Length, 0.034 mm; breadth, 0.085. Common in fresh water.

GOMPHONEMA ACUMINATUM Ehr. var. TURRIS (Ehr.) Cleve. Plate 12, fig. 4.

Gomphonema acuminatum Ehr. var. *turris* (Ehr.) Cleve, A. SCHMIDT, Atlas Diatom. (1902) pl. 239, figs. 34–36.

Valve slightly biconstricted. Striæ 16 to 18 in 0.01 mm. Length, 0.047 mm; breadth, 0.085. Common in fresh water. Rare in Kizaki Lake.

GOMPHONEMA ACUMINATUM Ehr. var. CORONATA (Ehr.) W. Smith. Plate 13, fig. 8.

Gomphonema acuminatum Ehr. var. *coronata* (Ehr.) W. Smith, FR. HUSTEDT, Bacillar. (1930) 370, fig. 684.

Valve slightly biconstricted, elongate. Length, 0.069 mm; breadth, 0.01. Rare in Kizaki Lake.

GOMPHONEMA PARVULUM (Kütz.) Grun. Plate 13, figs. 16 and 34.

Gomphonema parvulum (Kütz.) Grun., A. SCHMIDT, Atlas Diatom. (1902) pl. 234, fig. 14.

Valve elliptic-clavate with capitate ends. Length, 0.02 mm; breadth, 0.0065. Striæ 14 to 15 in 0.01 mm. Common in fresh water.

GOMPHONEMA PARVULUM (Kütz.) Grun. var. EXILISSIMA Grun. Plate 13, fig. 21.

Gomphonema parvulum (Kütz.) Grun. var. *exilissima* Grun., VAN HEURCK, Synopsis (1880–1881) pl. 25, fig. 12.

Valve narrow, lanceolate. Length, 0.017 mm; breadth, 0.0042. Striæ 15 in 0.01 mm. Uncommon.

GOMPHONEMA PARVULUM (Kütz.) Grun. var. MICROPUS (Kütz.) Cleve. Plate 13, fig. 9.

Gomphonema parvulum (Kütz.) Grun. var. *micropus* (Kütz.) Cleve, FR. HUSTEDT, Bacillar. (1930) 373, fig. 713c.

Valve slightly clavate with obtuse apex. Length, 0.011 mm; breadth, 0.005. Striæ 15 in 0.01 mm.

GOMPHONEMA PARVULUM (Kütz.) Grun. var. MICROPUS (Kütz.) Cleve fo. NIPPONICA fo. nov. Plate 13, fig. 36.

Valve minute, subovate with obtuse apex. Length, 0.009 mm; breadth, 0.0029. Striæ 18 in 0.01 mm. Isolated puncta indistinct. Differs from variety *micropus* in its closer striæ and smaller size.

GOMPHONEMA LANCEOLATUM Ehr. var. INSIGNIS (Greg.) Cleve. Plate 12, fig. 7; Plate 13, fig. 32.

Gomphonema lanceolatum Ehr. var. *insignis* (Greg.) Cleve, FR. HUSTEDT, Bacillar. (1930) 376, fig. 701.

Valve lanceolate, clavate, apex acuminate, slightly cuneate. Length, 0.04 to 0.06 mm; breadth, 0.0085 to 0.015. Striæ 8 to 9 in 0.01 mm. Common in fresh water.

GOMPHONEMA AUGUR Ehr. Plate 13, fig. 31.

Gomphonema augur Ehr., FR. HUSTEDT, Bacillar. (1930) 372, fig. 688.

Valve clavate with broad, truncate-apiculate apex. Length, 0.051 mm; breadth, 0.02. Striæ 10 in 0.01 mm. Uncommon in Kizaki Lake.

GOMPHONEMA AUGUR Ehr. var. GAUTIERI Van Heurck.

Gomphonema augur Ehr. var. *Gautieri* Van Heurck, FR. HUSTEDT, Bacillar. (1930) 372, fig. 689.

Like the type, but with longer valve. Length, 0.051 mm; breadth, 0.01. Common in Kizaki Lake.

GOMPHONEMA QUADRIPUNCTATUM (Oestr.) Wislouch var. HASTATA Wislouch. Plate 10, fig. 31.

Gomphonema quadripunctatus (Oestr.) Wislouch var. *hastata* WISLOUCH, Neue Untersuchungen über d. Diatomeen des Baikal-Sees (1924) 166–167, figs. a–c.

Valve clavate with attenuate and broad apex. Length, 0.044 mm; breadth, 0.009. Striæ radiate, 11 to 13 in 0.01 mm. Central area a broad fascia with four isolated puncta. Median line straight, with long terminal fissures. Rare. Reported from northern Europe, Baikal Lake, Manchurian Mongolia.

GOMPHONEMA SUBTILE Ehr. var. SAGITTA Schumann. Plate 10, fig. 19.

Gomphonema subtile Ehr. var. *sagitta* Schumann, A. SCHMIDT, Atlas Diatom. (1903) pl. 236, fig. 13.

Valve clavate with slightly capitate apex and narrow base. Length, 0.028 mm; breadth, 0.0034. Striæ 11 in 0.01 mm. Axial area linear. Known from Europe.

GOMPHONEMA LINGULATUM Hustedt. Plate 13, figs. 6 and 7.

Gomphonema lingulatum HUSTEDT, Bacillar. a. d. Aokikosee in Japan 166–167, pl. 5, fig. 5.

Valve clavate with broad, truncate, apiculate apex and narrow base. Length, 0.023 to 0.03 mm; breadth, 0.0068 to 0.008. Striæ marginal, 15 in 0.01 mm. No isolated punctum. Known only from Aokiko Lake, Nippon.

GOMPHONEMA OLIVACEUM (Lyngb.) Kütz. Plate 13, fig. 22.

Gomphonema olivaceum (Lyngb.) Kütz., Fr. Hustedt, Bacillar. (1930) 378, fig. 719.

Valve subclavate with broad, obtuse apex. Length, 0.024 mm; breadth, 0.006. Striæ 15 in 0.01 mm. Common in fresh water.

GOMPHONEMA OLIVACEUM (Lyngb.) Kütz. var. MINUTISSIMA Hustedt. Plate 13, fig. 39.

Gomphonema olivaceum (Lyngb.) Kütz. var. *minutissima* Hustedt, Bacillar. (1930) 378–379, fig. 720.

Like the type, but smaller. Length, 0.01 mm; breadth, 0.004. Striæ 15 in 0.01 mm. Uncommon.

GOMPHONEMA GRACILE Ehr. var. LANCEOLATA (Kütz.) Cleve. Plate 10, fig. 8.

Gomphonema gracile Ehr. var. *lanceolata* (Kütz.) Cleve, A. Schmidt, Atlas Diatom. (1903) pl. 236, figs. 26–28.

Valve lanceolate-clavate, with apiculate apex. Length, 0.035 mm; breadth, 0.0065. Striæ 15 in 0.01 mm. In fresh water, common in the Tropics.

GOMPHONEMA ABBREVIATUM Agardh? Kütz. Plate 13, fig. 42.

Gomphonema abbreviatum Agardh? Kütz., Fr. Hustedt, Bacillar. (1930) 379, fig. 722.

Valve clavate with broad ends. Length, 0.017 mm; breadth, 0.0034. Striæ marginal, 15 in 0.01 mm. Axial and central areas uniting in a broad linear-lanceolate space. Reported from fresh and brackish waters.

GOMPHONEMA INTRICATUM Kütz. Plate 13, figs. 14 and 41.

Gomphonema intricatum Kütz., A. Schmidt, Atlas Diatom. (1903) pl. 235, figs. 16–17.

Valve sublinear, slightly gibbous in the middle with obtuse apex and base. Length, 0.035 to 0.044 mm; breadth, 0.0056 to 0.0085. Striæ 12 in 0.01 mm. Common in fresh water.

GOMPHONEMA CONSTRICTUM Ehr. Plate 13, figs. 13 and 20.

Gomphonema constrictum Ehr., Fr. Hustedt, Bacillar. (1930) 377, fig. 714.

Valve clavate, biconstricted with rounded, truncate apex. Length, 0.039 to 0.044 mm; breadth, 0.01 to 0.014. Striæ 9 to 10 in 0.01 mm. Common in fresh water.

GOMPHONEMA CONSTRICTUM Ehr. var. CAPITATA (Ehr.) Cleve. Plate 13, fig. 23.

Gomphonema constrictum Ehr. var. *capitata* (Ehr.) Cleve, FR. HUSTEDT, Bacillar. (1930) 377, fig. 715.

Valve clavate with broad, truncate ends. Length, 0.03 to 0.039 mm; breadth, 0.006 to 0.0085. Striæ 12 in 0.01 mm. Common in Kizaki Lake.

GOMPHONEMA BERGGRENII Cleve. Plate 12, fig. 16.

Gomphonema Berggrenii CLEVE, Synopsis Navicul. Diatoms (1894) I, 185, pl. 5, figs. 6, 7; A. SCHMIDT, Atlas Diatom. (1903) pl. 240, figs. 26–30.

Valve clavate with broad subtruncate apex. Base elongate, narrow. Length, 0.044 mm; breadth, 0.0085. Axial area with an isolated punctum. The median stria opposite to the isolated punctum is shortened. Only known from fresh water in New Zealand.

GOMPHONEMA NIPPONICA sp. nov. Plate 12, fig. 3; Plate 13, fig. 24.

Valve elongate, clavate with subtruncate and constricted apex. Ends long, attenuate, obtuse. Length, 0.056 to 0.06 mm; breadth, 0.0085 to 0.01. Striæ robust, 9 in 0.01 mm. Axial area narrow, narrowed to the middle, unilateral. Central area unilateral, opposite to the stigma a broad stauros. Not common in Kizaki Lake. *Gomphonema bohemicum* Reichelt and Fricke and *G. dubia* Meister are nearly related to this new species.

EPITHEMIA CISTULA (Ehr.) var. LUNARIS Grun. Plate 9, fig. 12.

Epithemia cistula (Ehr.) var. *lunaris* GRUNOW, Beiträge zur Kenntniss der fossilen Diatomeen Osterreich-Ungarns (1903) 137–138, pl. 29, figs. 1, 2.

Epithemia hyndmannii W. Smith var. *chinensis* SKVORTZOW, Alpine Diatoms from South China (1929) 46, pl. 2, figs. 22, 23; pl. 3, fig. 9.

Valve lunate, gibbous on the dorsal side. Ends long, obtuse. Length, 0.057 to 0.06 mm; breadth, 0.011 to 0.014. Costæ 3, striæ 15, in 0.01 mm. Reported from fresh water in Bengal, India, from Foochow, southern China, and as a fossil from Dubravica, Hungary.

EPITHEMIA ZEBRA (Ehr.) Kütz.

Epithemia zebra (Ehr.) Kütz., FR. HUSTEDT, Bacillar. (1930) 384–385, fig. 729.

Valve linear with straight ventral side. Length, 0.085 mm; breadth, 0.01. Costæ 4, striæ 15, in 0.01 mm. Known from Aokiko Lake.

EPITHEMIA ZEBRA (Ehr.) Kütz. var. SAXONICA (Kütz.) Grun. Plate 10, fig. 21.

Epithemia zebra (Ehr.) Kütz. var. *saxonica* (Kütz.) Grun., FR. HUSTEDT, Bacillar. (1930) 385, fig. 730.

Valve linear, curved. The obtuse ends are slightly turned downwards. Length, 0.034 mm; breadth, 0.01. Striæ 13 to 14 in 0.01 mm. Not common in Kizaki Lake.

EPITHEMIA SOREX Kütz. Plate 15, fig. 12.

Epithemia sorex Kütz., Fr. Hustedt, Bacillar. (1930) 388, fig. 736.

Valve broad, gibbous on the dorsal side, slightly curved on the ventral side. Length, 0.025 mm; breadth, 0.008. Common in fresh and brackish waters. Reported from Aokiko Lake, Nippon.

RHOPALODIA GIBBA (Ehr.) O. Mull. Plate 9, fig. 2.

Rhopalodia gibba (Ehr.) O. Mull., Fr. Hustedt, Bacillar. (1930) 390, fig. 740.

Valve linear, arcuate, straight on the ventral side, reflexed at the extremities. Costæ 6 in 0.01 mm. Length, 0.111 mm; breadth, 0.0085. Common in Kizaki Lake.

RHOPALODIA GIBBERULA (Ehr.) O. Mull. Plate 8, fig. 12.

Rhopalodia gibberula (Ehr.) O. Mull., Fr. Hustedt, Bacillar. (1930) 391, fig. 742.

Valve gibbous in the middle of the dorsal side and straight on ventral side. Length, 0.045 mm; breadth, 0.022. A species of brackish waters. Not common in Kizaki Lake.

RHOPALODIA PARALLELA (Grun.) O. Mull. Plate 8, fig. 7; Plate 9, fig. 11.

Rhopalodia parallela (Grun.) O. Mull., Fr. Hustedt, Bacillar. (1930) 389–390, fig. 739.

Valve linear with parallel margins. Length, 0.062 to 0.2 mm; breadth, 0.018 to 0.03. Costæ 5 to 6 in 0.01 mm. Striæ 16 in 0.01 mm. An alpine species, known from many parts of the world.

NITZSCHIA FONTICOLA Grun. Plate 13, fig. 35.

Nitzschia fonticola Grun., Fr. Hustedt, Bacillar. (1930) 415, fig. 800.

Valve lanceolate with obtuse ends. Length, 0.01 mm; breadth, 0.0034. Costæ 12, striæ 24, in 0.01 mm. Not common in Kizaki Lake.

NITZSCHIA SIGMOIDEA (Ehr.) W. Smith. Plate 10, fig. 2.

Nitzschia sigmoidea (Ehr.) W. Smith, Fr. Hustedt, Bacillar. (1930) 419, fig. 810.

Valve sigmoid with parallel margins. Length, 0.34 to 0.38 mm; breadth, 0.01. This is the largest *Nitzschia* species in Kizaki Lake. Known from Aokiko Lake.

NITZSCHIA INTERRUPTA (Reichelt) Hustedt. Plate 13, fig. 1.

Nitzschia moissacensis var. *Heideni* MEISTER, in Beiträge zur Bacillar. Japans (1914) 229, pl. 8, fig. 10.

Nitzschia (*moissacensis* Herib. var.?) *Heideni* Meister, A. SCHMIDT, Atlas Diatom. (1924) pl. 351, figs. 9–13.

Nitzschia denticula GRUN., Diatom. Vega-Exped. (1883) 492, pl. 37, fig. 68.

Denticula interrupta Reichelt, KUNZE, Revisio 3, 392, fig.

Valve lanceolate with attenuate and slightly capitate ends. Costæ long, irregularly disposed, 5 in 0.01 mm. Striæ robust, elongate, 14 to 15 in 0.01 mm. Length, 0.03 to 0.035 mm; breadth, 0.0068 to 0.007. Common in Kizaki Lake. Reported from Aokiko Lake.

NITZSCHIA PALEA (Kütz.) W. Smith. Plate 13, figs. 19 and 28.

Nitzschia palea (Kütz.) W. Smith, FR. HUSTEDT, Bacillar. (1930) 416, fig. 801.

Valve linear-lanceolate with attenuate ends. Length, 0.029 to 0.032 mm; breadth, 0.0025 to 0.0042. Costæ 11 to 12 in 0.01 mm. Striæ very fine, about 35 in 0.01 mm. Common in Kizaki Lake.

NITZSCHIA PALEA (Kütz.) W. Smith var. TENUIROSTRIS Grun. Plate 13, fig. 2.

Nitzschia palea (Kütz.) W. Smith var. *tenuirostris* Grun., SKVORTZOW, Diatom recoltees par le Pere E. Licent (1935) 43, pl. 9, fig. 40.

Valve linear-lanceolate, slightly constricted in the middle part. Ends slightly capitate. Length, 0.037 mm; breadth, 0.0042. Costæ 10 to 11 in 0.01 mm. Striæ 35 in 0.01 mm. Not common.

NITZSCHIA DISSIPATA (Kütz.) Grun. Plate 13, figs. 17, 18, and 26.

Nitzschia dissipata (Kütz.) Grun., A. SCHMIDT, Atlas Diatom. (1921) pl. 332, fig. 23.

Valve linear-lanceolate with attenuate ends. Length, 0.02 to 0.057 mm; breadth, 0.0034 to 0.051. Costæ 7 in 0.01 mm. Striæ very fine, indistinct. Common in Kizaki Lake.

NITZSCHIA RECTA Hantzsch. Plate 13, fig. 25.

Nitzschia recta Hantzsch, FR. HUSTEDT, Bacillar. (1930) 411, fig. 785.

Valve linear with truncate, obtuse ends. Length, 0.093 to 0.098 mm; breadth, 0.005 to 0.006. Costæ 5 to 6 in 0.01 mm. Striæ indistinct. Common in fresh water.

NITZSCHIA COMMUNIS Rabenh. Plate 13, fig. 15.

Nitzschia communis Rabenh., FR. HUSTEDT, Bacillar. (1930) 417, fig. 798.

Valve broad-lanceolate with obtuse ends. Length, 0.014 mm; breadth, 0.0034. Costæ 12 in 0.01 mm. Striæ very indistinct. Common in fresh water.

NITZSCHIA CAPITELLATA Hustedt var. NIPPONICA var. nov. Plate 13, fig. 30.

Valve linear-lanceolate, constricted and rostrate-capitate. Length, 0.072 mm; breadth, 0.005. Costæ 7, striæ 30, in 0.01 mm. Differs from the type in its constricted valve and the different number of costæ.

NITZSCHIA VITREA Norman? Plate 13, fig. 29.

Nitzschia vitrea Norman, A. SCHMIDT, Atlas Diatom. (1921) pl. 334, figs. 16, 17.

Valve lanceolate, attenuate, and subrostrate. Length, 0.045 mm; breadth, 0.006. Costæ long, 8 in 0.01 mm. Striæ 18 in 0.01 mm. The Nippon form differs from the type in its short valve. A fresh-water species.

NITZSCHIA ACICULARIS W. Smith var. NIPPONICA var. nov. Plate 13, fig. 27.

Valve lanceolate with long horns or beaks. Length, 0.054 to 0.068 mm; breadth, 0.002 to 0.0025. Valve hyaline without striæ. Common in Kizaki Lake.

HANTZSCHIA AMPHIOXYS (Ehr.) Grun. Plate 13, fig. 11.

Hantzschia amphioxys (Ehr.) Grun., FR. HUSTEDT, Bacillar. (1930) 394, fig. 747.

Valve lanceolate, constricted at one side, convex from the other. Ends truncate, slightly curved. Length, 0.032 mm; breadth, 0.006. Costæ 8 to 9, striæ 18, in 0.01 mm. Common in Kizaki Lake.

HANTZSCHIA ELONGATA (Hantz.) Grun. Plate 8, fig. 3.

Hantzschia elongata (Hantz.) Grun., FR. HUSTEDT, Bacillar. (1930) 395, fig. 751.

Valve linear-lanceolate, attenuate towards the ends. Length, 0.195 mm; breadth, 0.01. Costæ 5, striæ 15, in 0.01 mm. Not common in Kizaki Lake.

CYMATOPLEURA SOLEA (Breb.) W. Smith var. GRACILIS Grun. Plate 15, fig. 6.

Cymatopleura solea (Breb.) W. Smith var. *gracilis* Grun., FR. HUSTEDT, Bacillar. (1930) 423.

Valve linear, constricted in the middle, panduriform, cuneate at both ends. Length, 0.127 to 0.13 mm; breadth, 0.018 to 0.019. Reported from Aokiko Lake, Nippon.

CYMATOPLEURA SOLEA (Breb.) W. Smith var. REGULA (Ehr.) Grun. Plate 15, fig. 7.

Cymatopleura solea (Breb.) W. Smith var. *regula* (Ehr.) Grun., Fr. Hustedt, Bacillar. (1930) 426, fig. 823b.

Valve linear, not constricted. Length, 0.062 mm; breadth, 0.001. Rare.

CYMATOPLEURA ELLIPTICA (Breb.) W. Smith. Plate 14, fig. 1.

Cymatopleura elliptica (Breb.) W. Smith, Fr. Hustedt, Bacillar. (1930) 426, fig. 825.

Valve broad-elliptic, cuneate. Length, 0.111 to 0.15 mm; breadth, 0.05 to 0.052. Common in Kizaki Lake.

SURIRELLA BISERIATA Breb. Plate 14, fig. 12.

Surirella biseriata Breb., Fr. Hustedt, Bacillar. (1930) 432, fig. 831.

Valve lanceolate with acute ends. Costæ reaching the median line, 2 in 0.01 mm. Long diameter, 0.142 mm; short diameter, 0.024. Common. Known from Aokiko Lake.

SURIRELLA BISERIATA Breb. fo. PUNCTATA Meister.

Surirella biseriata Breb. fo. *punctata* Meister, Fr. Hustedt, Bacillar. (1930) 433.

A form covered with puncta. Long diameter, 0.17 mm; short diameter, 0.032. Costæ 2 in 0.01 mm. Not common. Reported from Europe.

SURIRELLA BISERIATA Breb. var. NIPPONICA var. nov. Plate 14, fig. 11.

Valve elongate-lanceolate with acute ends. Costæ 2 to 3 in 0.01 mm. Long diameter, 0.2 to 0.23 mm; short diameter, 0.028 to 0.03. Differs from the type in its longer valve. *Surirella Engleri* O. Mull. var. *hankensis* Skvortzow [2] seems to be related to the above species. Common in Kizaki Lake.

SURIRELLA BISERIATA Breb. var. NIPPONICA fo. PUNCTATA fo. nov. Plate 15, fig. 3.

Valve punctate. Long diameter, 0.25 mm; short diameter, 0.027. Costæ 2 in 0.01 mm. Not common.

SURIRELLA BISERIATA Breb. var. CONSTRICTA Grun. fo. PUNCTATA fo. nov. Plate 14, fig. 14.

Valve constricted, acute and punctate. Median line linear. Long diameter, 0.12 mm; short diameter, 0.022. Known from Europe.

[2] Diatoms of Hanka Lake (1929) 37, pl. 8, fig. 3.

SURIRELLA BISERIATA Breb. var. BIFRONS (Ehr.) Hustedt fo. HISPIDA fo. nov. Plate 15, fig. 1.

Valve short-elliptic with acute ends, irregularly covered with horns. Long diameter, 0.102 mm; short diameter, 0.047. The variety *bifrons* was reported from Aokiko Lake.

SURIRELLA ROBUSTA Ehr. fo. LATA Hustedt. Plate 16, fig. 10.

Surirella robusta Ehr. fo. *lata* HUSTEDT, Bacillar. aus dem Aokikosee in Japan 170, fig. 1.

Valve ovate with one end much broader than the other. Costæ short, 1.5 to 2 in 0.01 mm, not reaching the pseudoraphe. Marginal keel forming wings in the middle part of the costæ. Pseudoraphe lanceolate. Polar areas large. Long diameter, 0.072 mm; short diameter, 0.03. Reported only from Nippon. Common in Kizaki Lake.

SURIRELLA ROBUSTA Ehr. var. SPLENDIDA (Ehr.) Van Heurck. Plate 14, fig. 3.

Surirella robusta Ehr. var. *splendida* (Ehr.) Van Heurck, FR. HUSTEDT, Bacillar. (1930) 437, figs. 851–852.

Valve narrow ovate, rounded at one end and acute at the other. Costæ not reaching the median area. Long diameter, 0.093 to 0.136 mm; short diameter, 0.025 to 0.047. Common. Reported from Aokiko Lake.

SURIRELLA ROBUSTA Ehr. var. SPLENDIDA (Ehr.) Van Heurck fo. HUSTEDTIANA (Mayer) Hustedt.

Surirella robusta Ehr. var. *splendida* (Ehr.) Van Heurck fo. *Hustedtiana* (Mayer) HUSTEDT, Bacillar. (1930) 438.

Valve elliptic-lanceolate with acute ends. Costæ not reaching the median area, parallel in the middle, radiate at the ends. Long diameter, 0.115 mm; short diameter, 0.037. Costæ 2 in 0.01 mm. Known from Europe.

SURIRELLA ROBUSTA Ehr. var. SPLENDIDA (Ehr.) Van Heurck fo. PUNCTATA Hustedt. Plate 16, fig. 2.

Surirella robusta Ehr. var. *splendida* (Ehr.) Van Heurck fo. *punctata* HUSTEDT, Bacillar. (1930) 437.

Valve with attenuate, rounded ends. Punctate between the costæ. Long diameter, 0.111 mm; short diameter, 0.037. Costæ 1 to 1.5 in 0.01 mm. Known from Europe.

SURIRELLA ROBUSTA Ehr. var. SPLENDIDA (Ehr.) Van Heurck fo. CONSTRICTA Hustedt. Plate 16, fig. 1.

Surirella robusta Ehr. var. *splendida* (Ehr.) Van Heurck fo. *constricta* HUSTEDT, Bacillar. (1930) 437.

Valve constricted. Long diameter, 0.153 mm; short diameter, 0.037. Rare.

SURIRELLA LINEARIS W. Smith. Plate 15, fig. 11.

Surirella linearis W. Smith, FR. HUSTEDT, Bacillar. (1930) 434, fig. 837.

Valve linear with cuneate ends. Alæ and costæ distinct. Median line linear. Long diameter, 0.042 mm; short diameter, 0.01. Costæ 2.5 in 0.01 mm. Reported from Aokiko Lake.

SURIRELLA LINEARIS W. Smith var. CONSTRICTA (Ehr.) Grun. Plate 14, fig. 7.

Surirella linearis W. Smith var. *constricta* (Ehr.) Grun., FR. HUSTEDT, Bacillar. (1930) 434, fig. 839.

Valve constricted. Long diameter, 0.072 mm; short diameter, 0.013. Costæ 2 in 0.01 mm. Found in Aokiko Lake, Nippon.

SURIRELLA LINEARIS W. Smith var. HELVETICA (Brun) Meister. Plate 16, fig. 8.

Surirella linearis W. Smith var. *helvetica* (Brun) Meister, FR. HUSTEDT, Bacillar. (1930) 434, fig. 840.

Valve linear with parallel margins, cuneate and punctate. Long diameter, 0.119 mm; short diameter, 0.034. Costæ 1.5 in 0.01 mm. Also reported from Aokiko Lake, Nippon.

SURIRELLA LINEARIS W. Smith var. NIPPONICA var. nov. Plate 15, fig. 9.

Valve linear with subcuneate ends, punctate. Outer rim robust. Marginal keel or alæ distinct. Costæ parallel, 2.5 to 3 in 0.01 mm. Median line linear. Long diameter, 0.052 mm; short diameter, 0.014. Variety *nipponica* is closely connected with variety *helvetica*.

SURIRELLA LINEARIS W. Smith var. NIPPONICA fo. CONSTRICTA fo. nov. Plate 15, fig. 8.

Valve constricted with attenuate and cuneate ends, punctate. Median line linear. Long diameter, 0.064 mm; short diameter, 0.01 to 0.012. Costæ 3 in 0.01 mm. Not common.

SURIRELLA LINEARIS W. Smith var. APICULATA var. nov. Plate 16, fig. 3.

Valve linear, slightly constricted with subrostrate ends. Costæ parallel, 3 in 0.01 mm, reaching the median line. Long diameter, 0.076 mm; short diameter, 0.014.

SURIRELLA CAPRONII Breb. var. OBTUSA Hustedt. Plate 14, fig. 5.

Surirella Capronii Breb. var. *obtusa* HUSTEDT, Bacillar. a. d. Aokikosee in Japan 170, fig. 2.

Valve elongate-ovate with one end much broader than the other. Ends obtuse. Outer rim robust. Area distinct and robust. Costæ not reaching the median area. On both ends of the median area two opposite horns. Polar area distinct. Long diameter, 0.136 mm; short diameter, 0.047. Known only from Aokiko and Kizaki Lakes.

SURIRELLA CAPRONII Breb. var. OBTUSA Hustedt fo. CAPITATA fo. nov. Plate 16, fig. 4.

Valve slightly constricted, one end very broad. Alæ and costæ robust, 1 in 0.01 mm. Long diameter, 0.156 mm; short diameter, 0.051.

SURIRELLA ELEGANS Ehr. fo. ELONGATA fo. nov. Plate 15, fig. 4.

Valve linear with one end much broader than the other. Costæ parallel, radiate at the ends, not reaching the median line. Long diameter, 0.215 mm; short diameter, 0.044. Costæ 2 in 0.01 mm. Differs from the type in its more elongate valves.

SURIRELLA TENERA Gregory. Plate 14, fig. 13.

Surirella tenera Gregory, FR. HUSTEDT, Bacillar. (1930) 438, fig. 853.

Valve elongate-ovate, rounded at one end and acute at the other. Outer rim narrow, smooth. Marginal alæ distinct. Costæ reaching the pseudoraphe, parallel in the middle, radiate at the ends. Long diameter, 0.138 to 0.14 mm; short diameter, 0.035. Common in fresh water. Not common in Kizaki Lake.

SURIRELLA TENERA Gregory var. PUNCTATA var. nov. Plate 12, fig. 14.

Punctate between the costæ. Long diameter, 0.136 mm; short diameter, 0.04. Uncommon.

SURIRELLA TENERA Gregory var. NERVOSA A. Schmidt. Plate 14, fig. 15.

Surirella tenera Gregory var. *nervosa* A. Schmidt, FR. HUSTEDT, Bacillar. (1930) 439, figs. 854–855.

Differs from the type in the median line being ornamented with a horn. Long diameter, 0.114 mm; short diameter, 0.034. Costæ 2 in 0.01 mm. Uncommon.

SURIRELLA TERRYANA Ward. Plate 16, fig. 11.

Surirella Terryana Ward, A. SCHMIDT, Atlas Diatom. (1912) pl. 280, figs. 7–8.

Valve linear with obtuse ends, margins parallel or slightly constricted in the middle. Outer rim narrow, finely crossbarred.

Costæ or ribs reaching the pseudoraphe, 3 in 0.01 mm, parallel in the middle, slightly radiate at the ends. Between the costæ are fine, closely set, parallel lines. Common in Kizaki and Aokiko Lakes. Known from North and South America only. *Surirella Chachinæ* Skvortzow [3] is closely connected with *Surirella Terryana.*

SURIRELLA TERRYANA Ward fo. MINUTA fo. nov. Plate 10, fig. 24; Plate 15, fig. 13.

Valve linear with parallel margins or slightly constricted, with rounded or cuneate ends. Costæ not reaching the pseudoraphe, 3 in 0.01 mm. Central area linear, extending the length of the valve. Long diameter, 0.037 to 0.04 mm; short diameter, 0.008 to 0.009. Striæ indistinct. Common.

SURIRELLA TERRYANA Ward var. NIPPONICA var. nov. Plate 15, fig. 2.

Valve linear, constricted, with cuneate long ends. Outer rim narrow, finely crossbarred. Costæ or ribs 2 in 0.01 mm, slightly curved, reaching the pseudoraphe. Striæ distinct. Long diameter, 0.124 to 0.13 mm; short diameter, in the middle part 0.014, at the ends 0.019. Uncommon.

SURIRELLA OVALIS Breb. var. NIPPONICA var. nov. Plate 13, fig. 4.

Valve ovate with outer rim robust, crossbarred. Costæ short, 2 in 0.01 mm, not reaching the median area. Between the costæ are fine, closely set, parallel lines. Median area is bounded by a closely set row of transverse lines, 18 in 0.01 mm. Long diameter, 0.098 mm; short diameter, 0.042. Variety *nipponica* differs from the type in its set row of transverse lines around the median area. *Surirella ovalis* is known as a brackish-water diatom.

SURIRELLA ANGUSTATA Kütz. Plate 3, fig. 15.

Surirella angustata Kütz., Fr. Hustedt, Bacillar. (1930) 435, figs. 844–845.

A minute species common in fresh water. Valve linear with cuneate ends. Costæ reaching the pseudoraphe, about 6 in 0.01 mm, parallel in the middle, radiate at the ends. Long diameter, 0.034 mm; short diameter, 0.011.

SURIRELLA PANTOCSEKII Meister. Plate 6, fig. 6.

Surirella Pantocsekii Meister, Beiträge zur Bacillar. Japans (1914) 230, pl. 8, figs. 14, 15.

Valve long-linear with panduriform rounded ends. Outer rim narrow, finely crossbarred. Costæ thin, short, parallel in the

[3] Diatoms from Hanka Lake (1929) 40, pl. 8, fig. 20.

middle, radiate at the ends with intercostal striæ. Central area narrow. Long diameter, 0.102 to 0.108 mm; short diameter, in the middle part 0.01, at the ends 0.013. Five fine costæ in 0.01 mm. Reported as occurring near Yokohama, Nippon. Known from Amur and Sungari Rivers, Manchuria. *Surirella tiensinensis* Skvortzow, from Tientsin, northern China, and from Hanka Lake, Siberia, differs from *S. Pantocsekii* only in its obtuse ends and smaller size.

SURIRELLA NIPPONICA sp. nov. Plate 8, fig. 17.

Valve lanceolate with attenuate ends. Costæ short, radiate, about 2 in 0.01 mm. Striæ distinct. Median area broad. Differs from *Surirella delicatissima* Lewis [4] in its broader valve and wider costæ.

STENOPTEROBIA INTERMEDIA (Lewis) fo. SUBACUTA Fricke. Plate 10, fig. 30.

Stenopterobia intermedia (Lewis) fo. *subacuta* Fricke, A. SCHMIDT, Atlas Diatom. (1912) pl. 284, fig. 6.

Valve sigmoid with inconspicuous alæ. Length, 0.119 mm; breadth, 0.004. Striæ 30 in 0.01 mm. Very rare. Known from Aokiko Lake (variety *capitata* Fontell.).

[4] A. Schmidt, Atlas Diatom. (1906) pl. 266, fig. 6.

ILLUSTRATIONS

PLATE 1

FIG. 1. *Melosira americana* Kütz.
2. *Melosira undulata* (Ehr.) Kütz. var. *Normanni* Arnott.
FIGS. 3 and 4. *Melosira Binderana* Kütz.
FIG. 5. *Melosira italica* (Ehr.) Kütz. subsp. *subarctica* O. Mull.
6. *Melosira italica* (Ehr.) Kütz. var. *tenuissima* (Grun.) O. Mull.
7. *Melosira italica* (Ehr.) Kütz. var. *valida* Grun.
8. *Melosira granulata* (Ehr.) Ralfs.
9. *Fragilaria pinnata* Ehr.
10. *Melosira distans* (Ehr.) Kütz.
11. *Cyclotella stelligera* Cleve and Grun.
12. *Cyclotella glomerata* Bachmann fo. *nipponica* fo. nov.
13. *Diatoma hiemale* (Lyngb.) Heiberg. var. *mesodon* (Ehr.) Grun.
14. *Synedra Vaucheriæ* Kütz.
15. *Synedra Vaucheriæ* Kütz. var. *capitellata* Grun.
16. *Tabellaria flocculosa* (Roth.) Kütz.
17. *Fragilaria construens* (Ehr.) Grun. var. *binodis* (Ehr.) Grun.
18. *Fragilaria brevistriata* Grun. var. *inflata* (Pant.) Hust. fo. *curta* fo. nov.
19. *Meridion circulare* Agardh.
20. *Synedra rumpens* Kütz. var. *nipponica* var. nov.
21. *Fragilaria capucina* Desm.
22. *Synedra parasitica* (W. Smith).
23. *Fragilaria gracillima* Mayer.
24. *Diatoma hiemale* (Lyngb.) Heiberg.
25. *Eunotia paludosa* Grun.
26. *Fragilaria crotonensis* Kitton.
27. *Synedra japonica* Meister.
FIGS. 28 and 29. *Fragilaria construens* (Ehr.) Grun.
FIG. 30. *Eunotia pectinalis* (Kütz.) Rabh. var. *minor* (Kütz.) Rabh.
31. *Eunotia veneris* (Kütz.) O. Mull. var. *nipponica* var. nov.
32. *Eunotia pectinalis* (Kütz.) Rabh. var. *nipponica* var. nov.
FIGS. 33 and 34. *Asterionella gracillima* (Hantzsch) Heiberg.
FIG. 35. *Tabellaria fenestrata* (Lyngb.) Kütz.
36. *Synedra Ulna* (Nitzsch) Ehr.
37. *Synedra Ulna* (Nitzsch) Ehr. var. *Ramesi* (Herib. and Perag.) Hust.
38. *Ceratoneis arcus* Kütz. var. *Hattoriana* Meister.
39. *Synedra Ulna* (Nitzsch) Ehr. var. *biceps* (Kütz.).
40. *Eunotia gracilis* (Ehr.) Rabh.
41. *Eunotia valida* Hust.
42. *Synedra Vaucheriæ* Kütz. var. *sigmoidea* var. nov.
43. *Synedra nipponica* sp. nov.
44. *Eunotia lunaris* (Ehr.) Grun.

PLATE 2

FIG. 1. *Diploneis Smithii* (Breb.) Cleve var. *nipponica* var. nov.
2. *Diploneis puella* (Schum.) Cleve.
3. *Diploneis elliptica* (Kütz.) Cleve var. *ladogensis* Cleve.
4. *Diploneis oculata* (Breb.) Cleve.
5. *Cocconeis placentula* (Ehr.) var. *lineata* (Ehr.) Cleve.
6. *Diploneis elliptica* (Kütz.) Cleve var. *ladogensis* Cleve.
7. *Navicula confervacea* Kütz. fo. *nipponica* fo. nov.
8. *Cocconeis placentula* (Ehr.) var. *klinoraphis* Geitler fo. *nipponica* fo. nov.
9. *Diploneis Smithii* (Breb.) Cleve var. *nipponica* var. nov.
10. *Achnanthes Peragalli* Brun and Herib. var. *nipponica* var. nov.

FIGS. 11 and 12. *Achnanthes lanceolata* Breb.

FIG. 13. *Navicula atomarius* sp. nov.
14. *Achnanthes Peragalli* Brun and Herib. var. *nipponica* var. nov.
15. *Achnanthes minutissima* Kütz.

FIGS. 16 to 18. *Cocconeis diminuta* Pant.?

FIG. 19. *Achnanthes pinnata* Hust. var. *nipponica* var. nov.
20. *Achnanthes lanceolata* Breb. var. *rostrata* Hust.
21. *Achnanthes minutissima* Kütz. var. *cryptocephala* Grun.
22. *Achnanthes microcephala* Kütz.
23. *Achnanthes minutissima* Kütz.
24. *Achnanthes Clevei* Grun. var. *nipponica* var. nov.
25. *Achnanthes kisaki* sp. nov.
26. *Diploneis ovalis* (Hilse) Cleve var. *oblongella* (Naegeli) Cleve.
27. *Opephora Martyi* Herib.
28. *Synedra Vaucheriæ* Kütz. var. *capitellata* Grun.
29. *Achnanthes lanceolata* Breb. var. *elliptica* Cleve.
30. *Achnanthes Peragalli* Brun and Herib.

FIGS. 31 and 32. *Achnanthes Oestrupii* (A. Cleve) Hust.

FIG. 33. *Melosira varians* C. A. Ag.
34. *Diatoma hiemale* (Lyngb.) Heiberg.
35. *Navicula Pusio* Cleve var. *arcuata* (Pantocsek) Skvortzow.
36. *Ceratoneis arcus* Kütz. var. *amphioxys* (Rabh.)
37. *Diploneis ovalis* (Hilse) Cleve.
38. *Achnanthes exigua* Grun. var. *indica* Skv.
39. *Eucocconeis flexella* (Kütz.).

PLATE 3

FIG. 1. *Neidium bisulcatum* (Lagerst.) Cleve var. *nipponica* var. nov.
2. *Navicula Brehmi* Hustedt fo. *elongata* fo. nov.
3. *Amphipleura pellucida* Kütz.
4. *Navicula dicephala* (Ehr.) W. Smith.
5. *Cymbella æqualis* W. Smith.
6. *Amphipleura pellucida* Kütz. var. *recta* Kitton.
7. *Gyrosigma Kützingii* (Grun.) Cleve.
8. *Synedra Ulna* (Nitzsch) Ehr.
9. *Caloneis silicula* Ehr. var. *baicalensis* Skv. and Meyer.
10. *Navicula globulifera* Hust. var. *nipponica* var. nov.
11. *Stauroneis Smithii* Grun.

FIG. 12. *Amphora delphinea* (Bailey) A. S. var. *minor* Cleve.
13. *Amphora perpusilla* Grun.
14. *Amphora ovalis* Kütz. var. *pediculus* Kütz.
15. *Surirella angustata* Kütz.
16. *Amphora ovalis* Kütz. fo. *gracilis* (Ehr.) Cleve.
17. *Amphora ovalis* Kütz. var. *libyca* (Ehr.) Cleve.
18. *Amphora Normanii* Rabh.
19. *Pinnularia mesolepta* (Ehr.) W. Smith.
20. *Cymbella cistula* (Hemp.) Grun.
21. *Stauroneis phœnicenteron* Ehr. fo. *nipponica* fo. nov.
22. *Synedra rumpens* Kütz. var. *Meneghiniana* Grun.
23. *Navicula americana* Ehr.

PLATE 4

FIG. 1. *Neidium Hitchcockii* Ehr.
2. *Neidium productum* (W. Smith) Cleve fo. *constricta* Hust.
FIGS. 3 and 4. *Achnanthes gracillima* Hust. var. *nipponica* var. nov.
FIG. 5. *Neidium oblique-striatum* A. S. var. *nipponica* var. nov.
6. *Neidium affine* (Ehr.) Cleve fo. *hercynica* (A. Mayer) Hust.
7. *Navicula Lambda* Cleve var. *densistriata* var. nov.
8. *Neidium bisulcatum* (Lagerst.) Cleve var. *nipponica* var. nov.
9. *Navicula exigua* (Greg.) O. Mull.
10. *Navicula pupula* Kütz. var. *capitata* Hust.
11. *Frustulia vulgaris* Thwaites.
12. *Frustulia rhomboides* (Ehr.) de Toni var. *saxonica* (Rabh.) de Toni fo. *capitata* A. Mayer.
13. *Navicula holophila* (Grun.) Cleve fo. *minor* Kolbe.
14. *Navicula muralis* Grun.
15. *Navicula pseudoscutiformis* Hust.
16. *Neidium oblique-striatum* A. S. var. *rostrata* var. nov.
17. *Caloneis silicula* (Ehr.) Cleve var. *truncatula* Grun.
18. *Frustulia rhomboides* (Ehr.) de Toni var. *amphipleuroides* Grun.
19. *Frustulia rhomboides* (Ehr.) de Toni.
FIGS. 20 and 21. *Navicula Pusio* Cleve.
FIG. 22. *Neidium oblique-striatum* A. S. var. *nipponica* var. nov.
23. *Navicula confervacea* Kütz. fo. *nipponica* fo. nov.
24. *Neidium oblique-striatum* A. S. var. *apiculata* var. nov.
25. *Navicula Rotæana* (Rabh.) Grun.
26. *Achnanthes pinnata* Hust. var. *japonica* Hust.
27. *Stauroneis Smithii* Grun. var. *incisa* Pant.

PLATE 5

FIG. 1. *Navicula hasta* Pant.
2. *Navicula rhynchocephala* Kütz.
3. *Navicula rostellata* Kütz.
4. *Navicula lanceolata* (Agardh) Kütz.
5. *Navicula placentula* (Ehr.) Grun. fo. *rostrata* Mayer.
6. *Navicula lacustris* Greg.
7. *Navicula globulifera* Hust.
8. *Navicula radiosa* Kütz.
9. *Navicula falaisiensis* Grun. var. *lanceola* Grun.

FIG. 10. *Navicula aqueductæ* Krasske fo. *minores* Krasske.
11. *Navicula crucicula* (W. Smith) Donk. var. *capitata* var. nov.
12. *Navicula lapidosa* Krasske var. *nipponica* var. nov.
13. *Navicula similis* Krasske.
14. *Stauroneis anceps* Ehr. var. *linearis* (Ehr.) Cleve.
15. *Stauroneis anceps* Ehr.
16. *Navicula menisculus* Schumann.
17. *Navicula lanceolata* (Agardh) Kütz. var. *cymbula* (Donk.) Cleve.
18. *Navicula anglica* Ralfs.
19. *Stauroneis phœnicenteron* Ehr.
20. *Stauroneis anceps* Ehr. fo. *gracilis* (Ehr.) Cleve.
21. *Navicula salinatum* Grun. var. *nipponica* var. nov.
22. *Navicula rostellata* Kütz. var. *nipponica* var. nov.
23. *Cymbella hybrida* Grun.
24. *Navicula peregrina* (Ehr.) Kütz. var. *cuneata* var. nov.

PLATE 6

FIG. 1. *Pinnularia platycephala* (Ehr.) Cleve.
2. *Pinnularia platycephala* Cleve var. *Hattoriana* Meister.
3. *Pinnularia karelica* Cleve var. *japonica* Hust. fo. *obtusa* fo. nov.
4. *Pinnularia karelica* Cleve var. *japonica* Hust.
5. *Pinnularia Hartleyana* Greville.
6. *Surirella Pantocsekii* Meister.
7. *Pinnularia microstauron* (Ehr.) Cleve var. *kisakensis* var. nov.
8. *Pinnularia microstauron* (Ehr.) Cleve var. *nipponica* var. nov.
9. *Achnanthes gracillima* Hust. var. *nipponica* var. nov.
10. *Pinnularia major* (Kütz.) Cleve.
11. *Pinnularia viridis* (Nitzsch) Ehr. var. *leptogongyla* (Ehr. Grun.) Cleve.
12. *Pinnularia karelica* Cleve var. *insularis* var. nov.
13. *Pinnularia molaris* Grun.
14. *Pinnularia viridis* (Nitzsch) Ehr. var. *nipponica* var. nov.
15. *Navicula falaisiensis* Grun. var. *nipponica* var. nov.
16. *Navicula cuspidata* Kütz.

PLATE 7

FIG. 1. *Pinnularia Ueno* sp. nov.
FIGS. 2 and 3. *Pinnularia gibba* Ehr.
FIG. 4. *Pinnularia legumen* Ehr. var. *nipponica* var. nov.
5. *Pinnularia dactylus* Ehr. var. *Dariana* A. S. fo. *nipponica* fo. nov.
6. *Pinnularia microstauron* (Ehr.) Cleve.
FIGS. 7 and 8. *Achnanthes exigua* Grun. var. *nipponica* var. nov.
FIG. 9. *Pinnularia viridis* (Nitzsch) Ehr. var. *intermedia* Cleve.
10. *Pinnularia gibba* Ehr. var. *nipponica* var. nov.
11. *Pinnularia major* (Kütz.) Cleve var. *linearis* Cleve.
12. *Pinnularia nipponica* sp. nov.
13. *Pinnularia Okamuræ* sp. nov.
14. *Navicula cryptocephala* Kütz. var. *veneta* (Kütz.) Grun.

FIG. 15. *Pinnularia gibba* Ehr. fo. *subundulata* Mayer.
16. *Achnanthes exigua* Grun.
17. *Pinnularia borealis* Ehr.
18. *Pinnularia microstauron* (Ehr.) Grun. var. *ambigua* Meister fo. *diminuta* Grun.

PLATE 8

FIG. 1. *Neidium nipponica* sp. nov.
2. *Pinnularia viridis* (Nitzsch) Ehr. var. *nipponica* var. nov.
3. *Hantzschia elongata* (Hantz.) Grun.
4. *Navicula palea* sp. nov.
5. *Pinnularia Hustedtii* Meister.
6. *Pinnularia legumen* Ehr.
7. *Rhopalodia parallela* (Grun.) O. Mull.
8. *Achnanthes lanceolata* Breb. var. *rostrata* Hust.
9. *Navicula lacustris* Greg.
10. *Eunotia tropica* Hust.
11. *Actinella brasiliensis* Grun.
12. *Rhopalodia gibberula* (Ehr.) O. Mull.
13. *Cyclotella comta* (Ehr.) Kütz. fo. *parva* fo. nov.
14. *Cyclotella Meneghiniana* Kütz. var. *nipponica* var. nov.
15. *Pinnularia leptosoma* Grun. var. *nipponica* var. nov.
16. *Eunotia tropica* Hust.
17. *Surirella nipponica* sp. nov.

PLATE 9

FIG. 1. *Diploneis Smithii* (Breb.) Cleve var. *oblongella* var. nov.
2. *Rhopalodia gibba* (Ehr.) O. Mull.
3. *Caloneis silicula* (Ehr.) Cleve var. *tumida* Hust. fo. *nipponica* fo. nov.
4. *Stauroneis phœnicenteron* Ehr. fo. *nipponica* fo. nov.
5. *Pinnularia tabellaria* Ehr.
6. *Navicula perpusilla* Grun.
7. *Pinnularia viridis* (Nitzsch) Ehr. var. *fallax* Cleve.
8. *Navicula leptosoma* Grun.
9. *Pinnularia montana* Hust. fo. *minor* fo. nov.
10. *Pinnularia microstauron* (Ehr.) Cleve var. *nipponica* var. nov.
11. *Rhopalodia parallela* (Grun.) O. Mull.
12. *Epithemia cistula* (Ehr.) var. *lunaris* Grun.
13. *Ceratoneis arcus* Kütz. var. *amphioxys* (Rabh.).
14. *Gyrosigma acuminatum* (Kütz.) Rabh.
15. *Fragilaria virescens* Ralfs.
16. *Ceratoneis arcus* Kütz. var. *amphioxys* (Rabh.).
17. *Cymbella sinuata* Greg. var. *antiqua* Grun.
18. *Diatoma hiemale* (Lyngb.) Heiberg var. *mesodon* (Ehr.) Grun.
19. *Cymbella aspera* (Ehr.) Cleve var. *truncata* (Rabh.) Dipp.
20. *Navicula amphibola* Cleve.
21. *Pinnularia viridis* (Nitzsch) Ehr. var. *sudetica* (Hilse) Hust.

PLATE 10

FIG. 1. *Pinnularia nobilis* Ehr.
2. *Nitzschia sigmoides* (Ehr.) W. Smith.
3. *Navicula cryptocephala* Kütz.
4. *Cymbella japonica* Reichelt.
5. *Navicula lanceolata* (Agardh) Kütz.
6. *Melosira Binderana* Kütz.
7. *Diatoma vulgare* Bory var. *linearis* Grun.
8. *Gomphonema gracile* Ehr. var. *lanceolata* (Kütz.) Cleve.
9. *Synedra japonica* Meister.
10. *Synedra Ulna* (Nitzsch) Ehr. var. *danica* (Kütz.) Grun.
11. *Gomphonema vastum* Hust. var. *cuneata* var. nov.
12. *Melosira distans* (Ehr.) Kütz. var. *lirata* (Ehr.) Bethge.
13. *Diatoma hiemale* (Lyngb.) Heiberg.
14. *Cymbella Reinhardtii* Grun.
15. *Fragilaria construens* (Ehr.) Grun. var. *nipponica* var. nov.
16. *Navicula atomus* (Naeg.) Grun. var. *nipponica* var. nov.
17. *Achnanthes linearis* W. Smith var. *pusilla* Grun.
18. *Achnanthes lanceolata* Breb. var. *rostrata* Hust.
19. *Gomphonema subtile* Ehr. var. *sagitta* Schum.
20. *Navicula placenta* (Ehr.) Grun. fo. *nipponica* fo. nov.
21. *Epithemia zebra* (Ehr.) Kütz. var. *saxonica* (Kütz.) Grun.
22. *Synedra Goulardii* (Breb.) Grun.
23. *Stauroneis Smithii* Grun. var. *nipponica* var. nov.
24. *Surirella Terryana* Ward fo. *minuta* fo. nov.
25. *Diatoma hiemale* (Lyngb.) Heiberg var. *mesodon* (Ehr.) Grun.
26. *Pinnularia lignitica* Cleve.
27. *Achnanthes affinis* Grun. var. *minuta* var. nov.
28. *Meridion circulare* Agardh var. *constricta* (Ralfs) Van Heurck.
29. *Synedra nana* Meister var. *nipponica* var. nov.
30. *Stenopterobia intermedia* (Lewis) fo. *subacuta* Fricke.
31. *Gomphonema quadripunctatum* (Oestr.) Wislouch var. *hastata* Wislouch.
32. *Fragilaria construens* (Ehr.) Grun. var. *triundulata* Reichelt.
33. *Cymbella prostrata* (Berkeley) Cleve.

PLATE 11

FIG. 1. *Cymbella japonica* Reichelt.
2. *Cymbella æqualis* W. Smith.
3. *Cymbella Ehrenbergii* Kütz.
4. *Cymbella heteropleura* Ehr. var. *minor* Cleve.
5. *Cymbella gracilis* Rabh.
6. *Cymbella naviculiformis* Auerswald.
7. *Cymbella japonica* Reichelt.
8. *Cymbella ventricosa* Kütz.

FIGS. 9 and 10. *Cymbella affinis* Kütz.

FIG. 11. *Navicula minuscula* Grun.
12. *Anomœoneis exilis* (Kütz.) Cleve var. *nipponica* var. nov.
13. *Cymbella heteropleura* Ehr. fo. *nipponica* fo. nov.
14. *Cymbella ventricosa* Kütz.
15. *Cymbella sinuata* Greg.

FIG. 16. *Cymbella tumida* (Breb.) Van Heurck var. *borealis* Grun.
17. *Cymbella tumida* (Breb.) Van Heurck.
18. *Cymbella ventricosa* Kütz.
19. *Fragilaria construens* (Ehr.) Grun. var. *subsalina* Hustedt.
20. *Cymbella turgida* (Greg.) Cleve.
21. *Cymbella cymbiformis* (Agardh, Kütz.) Van Heurck.
22. *Navicula Pusio* Cleve.
23. *Cymbella cuspidata* Kütz.
24. *Cymbella turgidula* Grun.
25. *Cymbella microcephala* Grun.

PLATE 12

FIG. 1. *Pinnularia brevicostata* Cleve.
2. *Cyclotella comta* (Ehr.) Kütz. var. *paucipunctata* Grun.
3. *Gomphonema nipponica* sp. nov.
4. *Gomphonema acuminatum* Ehr. var. *turris* (Ehr.) Cleve.
5. *Gyrosigma scalproides* (Rabh.) Cleve.
6. *Opephora Okadæ* sp. nov.
7. *Gomphonema lanceolatum* Ehr. var. *insignis* (Greg.) Cleve.
8. *Opephora Martyi* Herib. var. *robusta* var. nov.
9. *Diploneis marginestriata* Hust.
10. *Neidium dubium* (Ehr.) Cleve.
11. *Pinnularia mesolepta* (Ehr.) W. Smith.
12. *Cymbella alpina* Grun.
13. *Achnanthes lanceolata* Breb. var. *nipponica* var. nov.
14. *Surirella tenera* Greg. var. *punctata* var. nov.
15. *Navicula pupula* Kütz.
16. *Gomphonema Berggrenii* Cleve.
17. *Achnanthes Oestrupii* (A. Cleve) Hust.
18. *Pinnularia viridis* (Nitzsch) Ehr. var. *fallax* Cleve.
19. *Neidium Kozlowi* Meresch. var. *nipponica* var. nov.
20. *Fragilaria virescens* Ralfs var. *elliptica* Hust. fo. *nipponica* fo. nov.
21. *Fragilaria pinnata* Ehr.
22. *Cymbella gracilis* (Rabh.) Cleve fo. *minor* fo. nov.
23. *Eunotia septentrionalis* Oestr.
24. *Pinnularia divergentissima* Grun.
25. *Eunotia prærupta* Ehr.
26. *Achnanthes Hauckiana* Grun.

PLATE 13

FIG. 1. *Nitzschia interrupta* (Reich.) Hust.
2. *Nitzschia palea* (Kütz.) W. Smith var. *tenuirostris* Grun.
3. *Opephora Martyi* Herib.
4. *Surirella ovalis* Breb. var. *nipponica* var. nov.
5. *Gomphonema vastum* Hust.

FIGS. 6 and 7. *Gomphonema lingulatum* Hust.

FIG. 8. *Gomphonema acuminatum* Ehr. var. *coronata* (Ehr.) W. Smith.
9. *Gomphonema parvulum* (Kütz.) Grun. var. *micropus* (Kütz.) Cleve.
10. *Opephora Martyi* Herib. var. *robusta* var. nov.

FIG. 11. *Hantzschia amphioxys* (Ehr.) Grun.
12. *Opephora Martyi* Herib. var. *elongata* var. nov.
13. *Gomphonema constrictum* Ehr.
14. *Gomphonema intricatum* Kütz.
15. *Nitzschia communis* Rabh.
16. *Gomphonema parvulum* (Kütz.) Grun.

FIGS. 17 and 18. *Nitzschia dissipata* (Kütz.) Grun.

FIG. 19. *Nitzschia palea* (Kütz.) W. Smith.
20. *Gomphonema constrictum* Ehr.
21. *Gomphonema parvulum* (Kütz.) Grun. var. *exilissima* Grun.
22. *Gomphonema olivaceum* (Lyngb.) Kütz.
23. *Gomphonema constrictum* Ehr. var. *capitata* (Ehr.) Cleve.
24. *Gomphonema nipponica* sp. nov.
25. *Nitzschia recta* Hantzsch.
26. *Nitzschia dissipata* (Kütz.) Grun.
27. *Nitzschia acicularis* W. Smith var. *nipponica* var. nov.
28. *Nitzschia palea* (Kütz.) W. Smith.
29. *Nitzschia vitrea* Norman?
30. *Nitzschia capitellata* Hust. var. *nipponica* var. nov.
31. *Gomphonema augur* Ehr.
32. *Gomphonema lanceolatum* Ehr. var. *insignis* (Greg.) Cleve.
33. *Gomphonema vastum* Hust. var. *elongata* var. nov.
34. *Gomphonema parvulum* (Kütz.) Grun.
35. *Nitzschia fonticola* Grun.
36. *Gomphonema parvulum* (Kütz.) Grun. var. *micropus* (Kütz.) Cleve fo. *nipponica* fo. nov.
37. *Synedra cyclopum* Brutschi var. *nipponica* var. nov.
38. *Gomphonema acuminatum* Ehr.
39. *Gomphonema olivaceum* (Lyngb.) Kütz. var. *minutissima* Hust.
40. *Gomphonema vastum* Hust. var. *elongata* var. nov.
41. *Gomphonema intricatum* Kütz.
42. *Gomphonema abbreviatum* Agardh? Kütz.

PLATE 14

FIG. 1. *Cymatopleura elliptica* (Breb.) W. Smith.
2. *Diploneis oculata* (Breb.) Cleve var. *nipponica* var. nov.
3. *Surirella robusta* Ehr. var. *splendida* (Ehr.) Van Heurck.
4. *Eunotia faba* (Ehr.) Grun. var. *nipponica* var. nov.
5. *Surirella Capronii* Breb. var. *obtusa* Hust.
6. *Achnanthes Hauckiana* Grun. var. *elliptica* Schulz. fo. *nipponica* fo. nov.
7. *Surirella linearis* W. Smith var. *constricta* (Ehr.) Grun.
8. *Fragilaria Harrissonii* W. Smith var. *rhomboides* Grun.
9. *Fragilaria brevistriata* Grun.
10. *Eunotia pectinalis* (Kütz.) Rabh. var. *minor* (Kütz.) Rabh. fo. *impressa* (Ehr.).
11. *Surirella biseriata* Breb. var. *nipponica* var. nov.
12. *Surirella biseriata* Breb.
13. *Surirella tenera* Greg.
14. *Surirella biseriata* Breb. var. *constricta* Grun. fo. *punctata* fo. nov.
15. *Surirella tenera* Greg. var. *nervosa* A. Schmidt.

PLATE 15

FIG. 1. *Surirella biseriata* Breb. var. *bifrons* (Ehr.) Hust. fo. *hispida* fo. nov.
2. *Surirella Terryana* Ward var. *nipponica* var. nov.
3. *Surirella biseriata* Breb. var. *nipponica* fo. *punctata* fo. nov.
4. *Surirella elegans* Ehr. fo. *elongata* fo. nov.
5. *Navicula mutica* Kütz.
6. *Cymatopleura solea* (Breb.) W. Smith var. *gracilis* Grun.
7. *Cymatopleura solea* (Breb.) W. Smith var. *regula* (Ehr.) Grun.
8. *Surirella linearis* W. Smith var. *nipponica* var. nov. fo. *constricta* fo. nov.
9. *Surirella linearis* W. Smith var. *nipponica* var. nov.
10. *Cymbella Kawamuræ* sp. nov.
11. *Surirella linearis* W. Smith.
12. *Epithemia sorex* Kütz.
13. *Surirella Terryana* Ward fo. *minuta* fo. nov.

PLATE 16

FIG. 1. *Surirella robusta* Ehr. var. *splendida* (Ehr.) Van Heurck fo. *constricta* Hust.
2. *Surirella robusta* Ehr. var. *splendida* (Ehr.) Van Heurck fo. *punctata* Hust.
3. *Surirella linearis* W. Smith var. *apiculata* var. nov.
4. *Surirella Capronii* Breb. var. *obtusa* Hust. fo. *capitata* fo. nov.
5. *Fragilaria Harrissonii* W. Smith.
6. *Fragilaria Harrissonii* W. Smith var. *dubia* Grun.
7. *Fragilaria brevistriata* Grun. var. *nipponica* var. nov.
8. *Surirella linearis* W. Smith var. *helvetica* (Brun) Meister.
9. *Fragilaria construens* (Ehr.) Grun. var. *binodis* (Ehr.) Grun.
10. *Surirella robusta* Ehr. fo. *lata* Hust.
11. *Surirella Terryana* Ward.
12. *Navicula kizakiensis* sp. nov.
13. *Fragilaria construens* (Ehr.) Grun. var. *nipponica* var. nov.
14. *Pinnularia Balfouriana* Grun. var. *stauroptera* var. nov.
15. *Pinnularia borealis* Ehr.

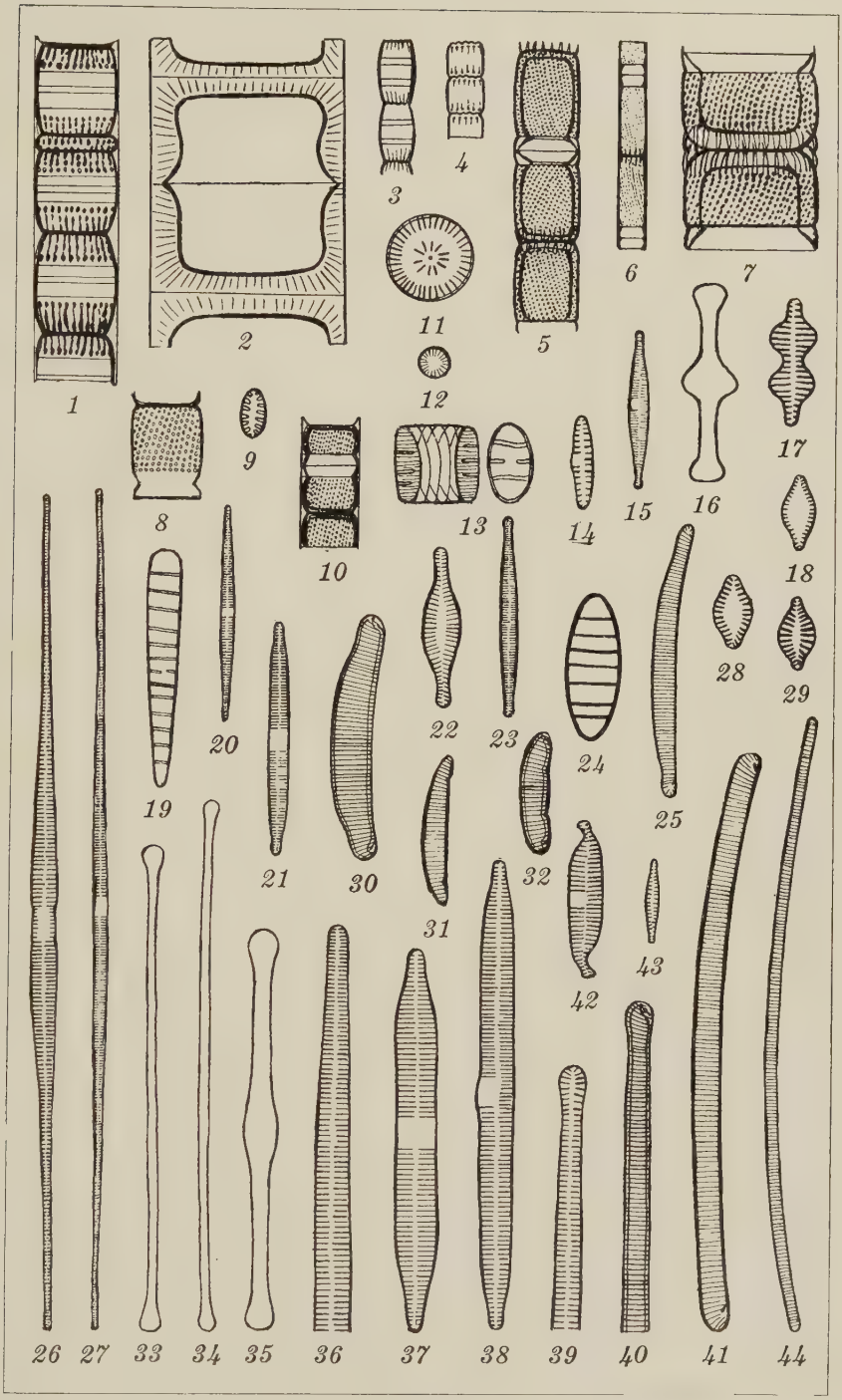
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PLATE 1.

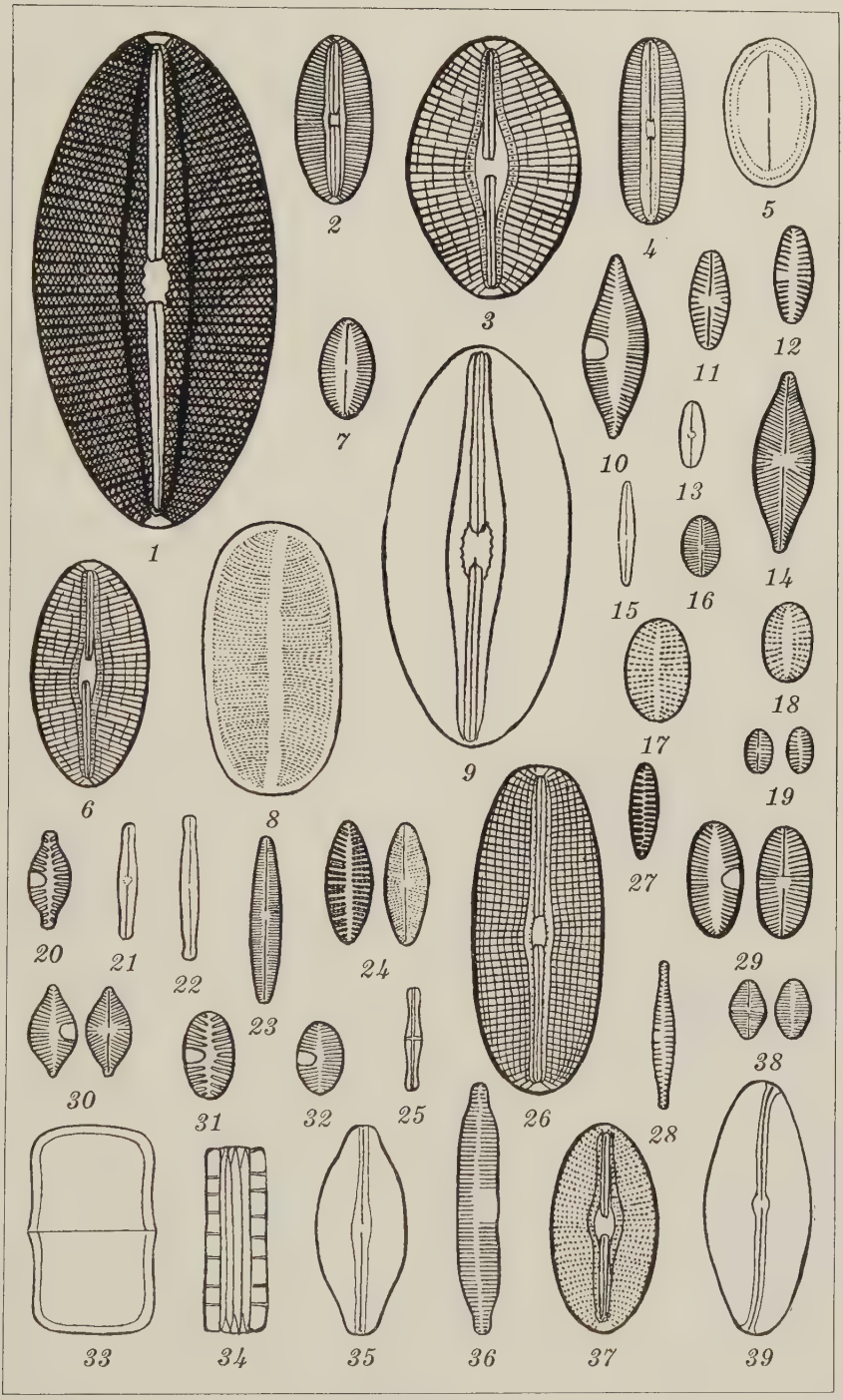
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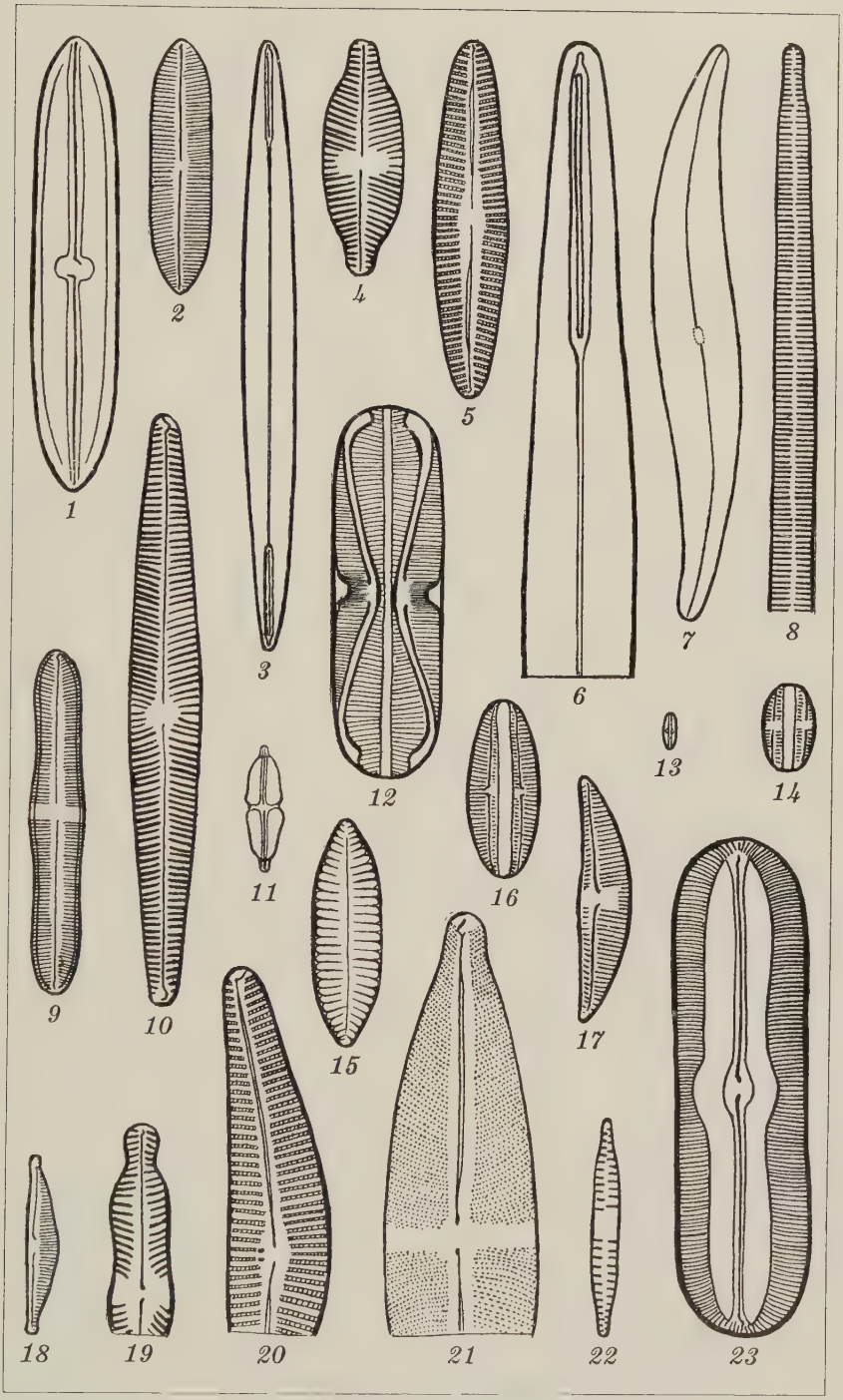
PLATE 2.



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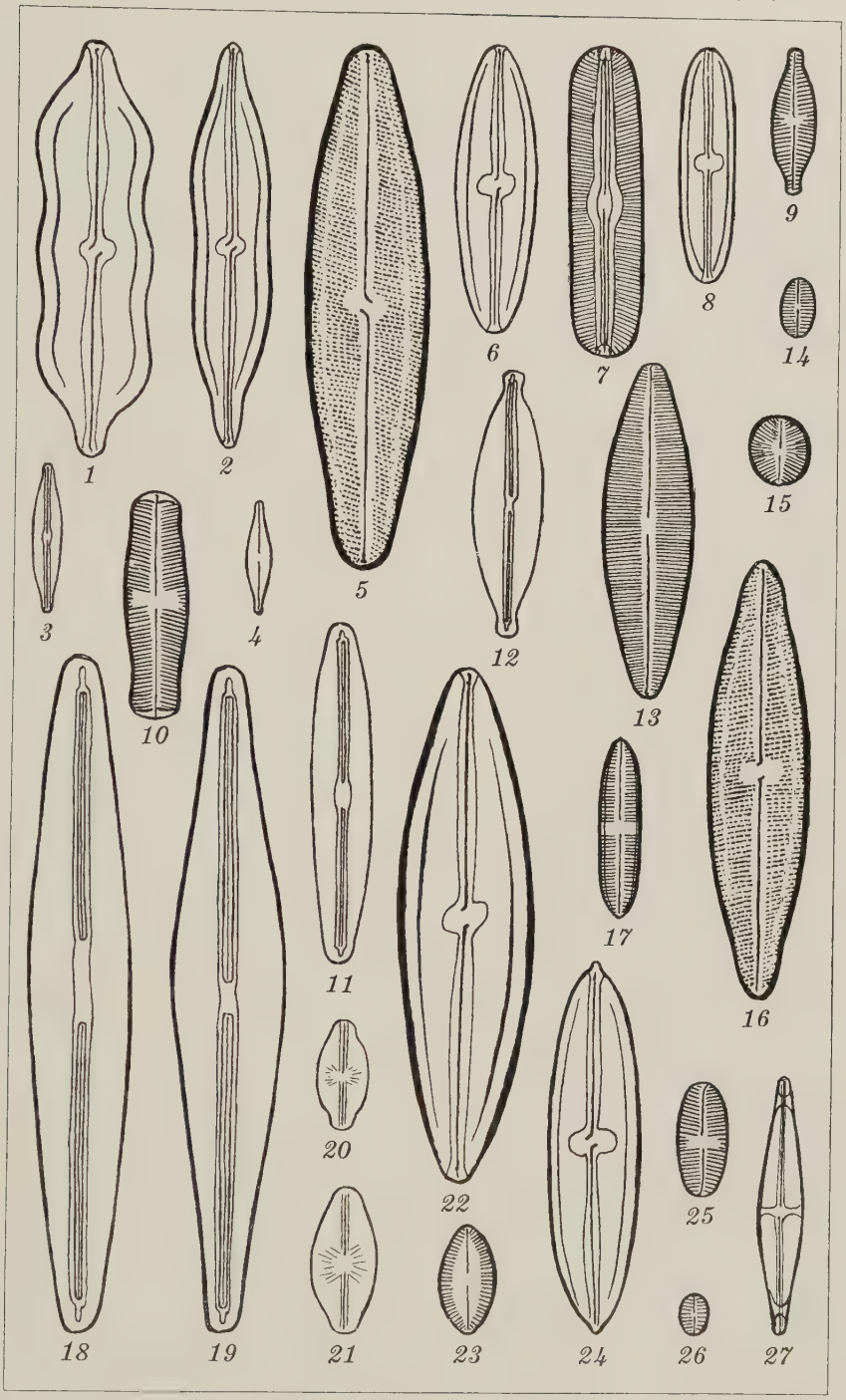

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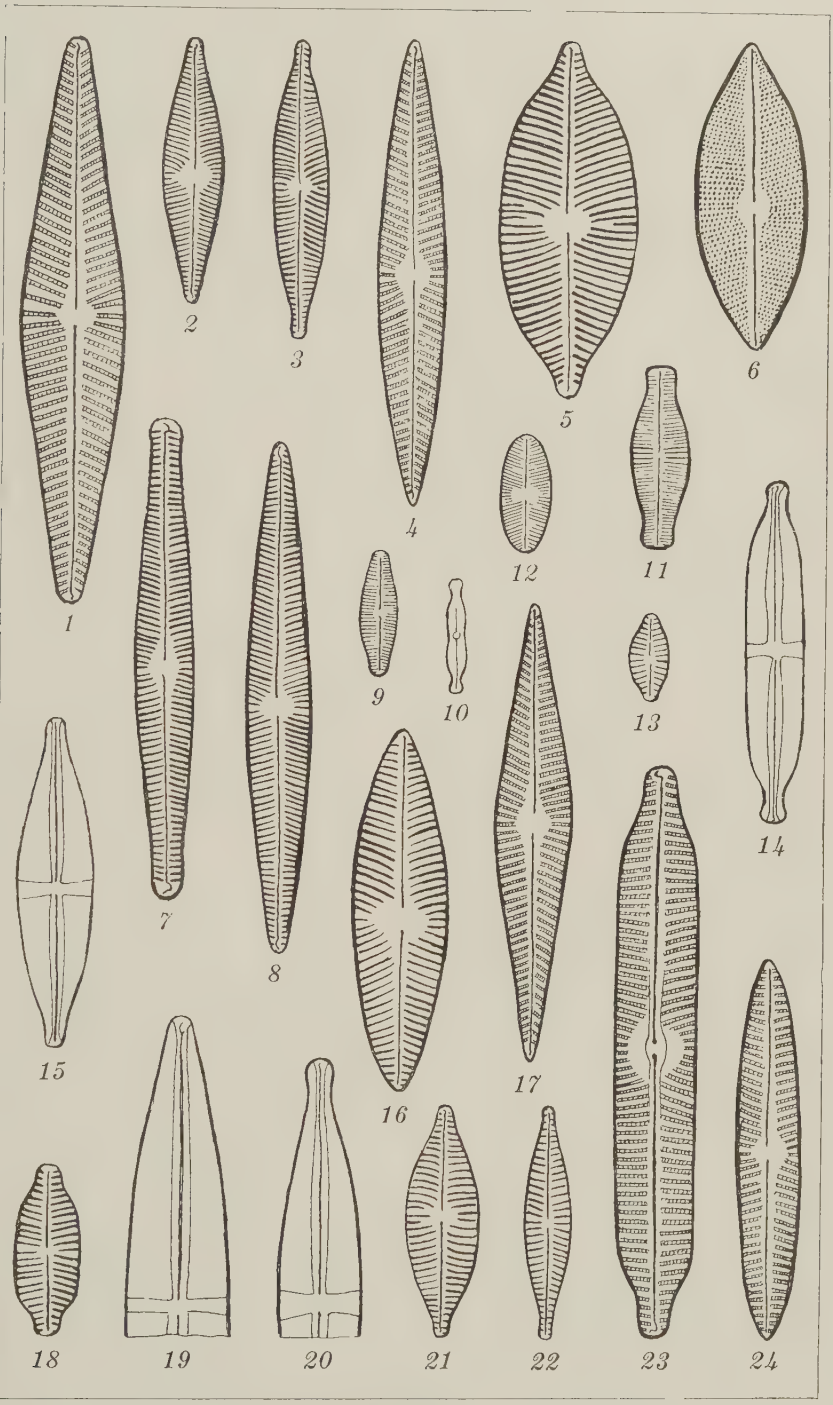

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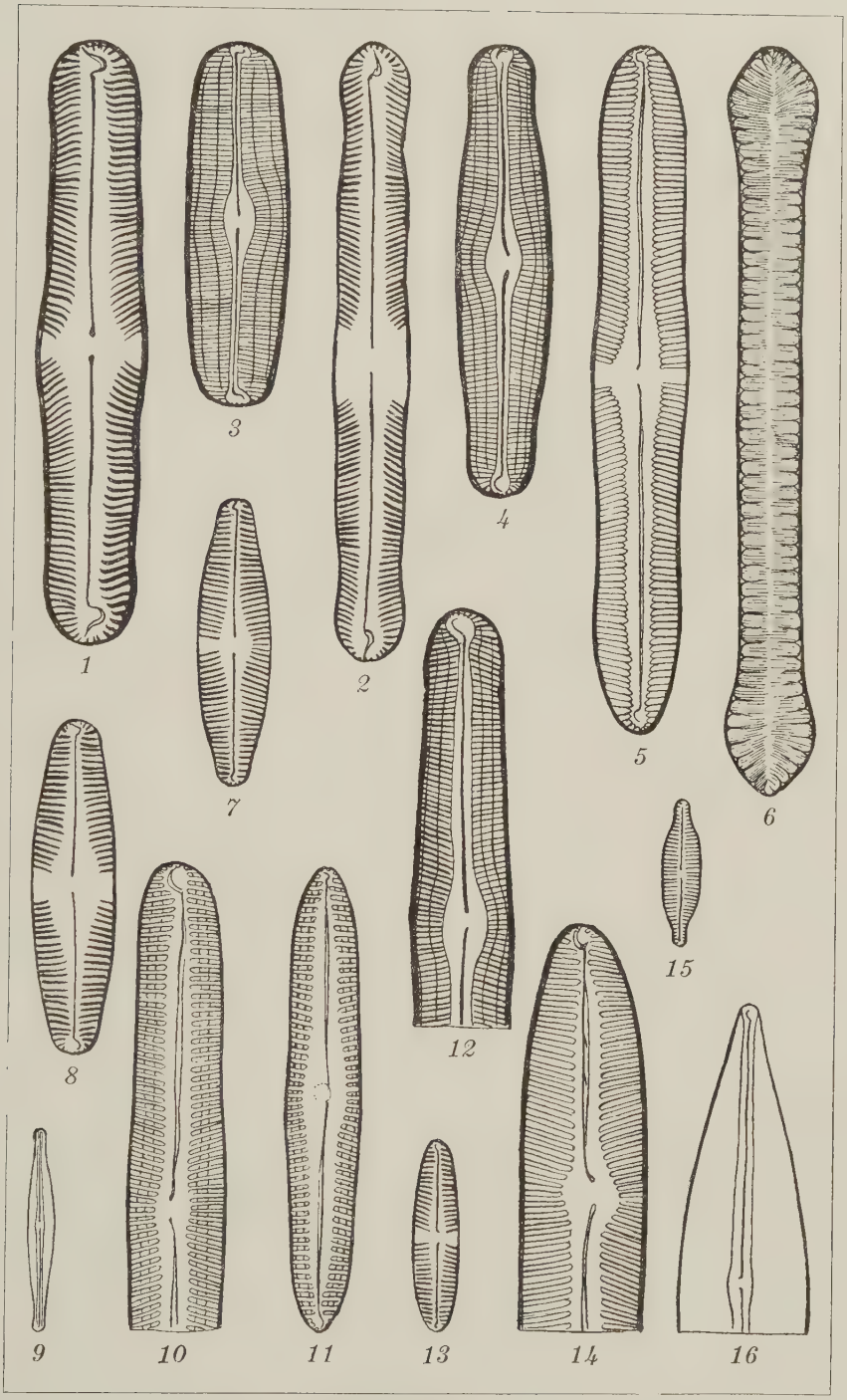

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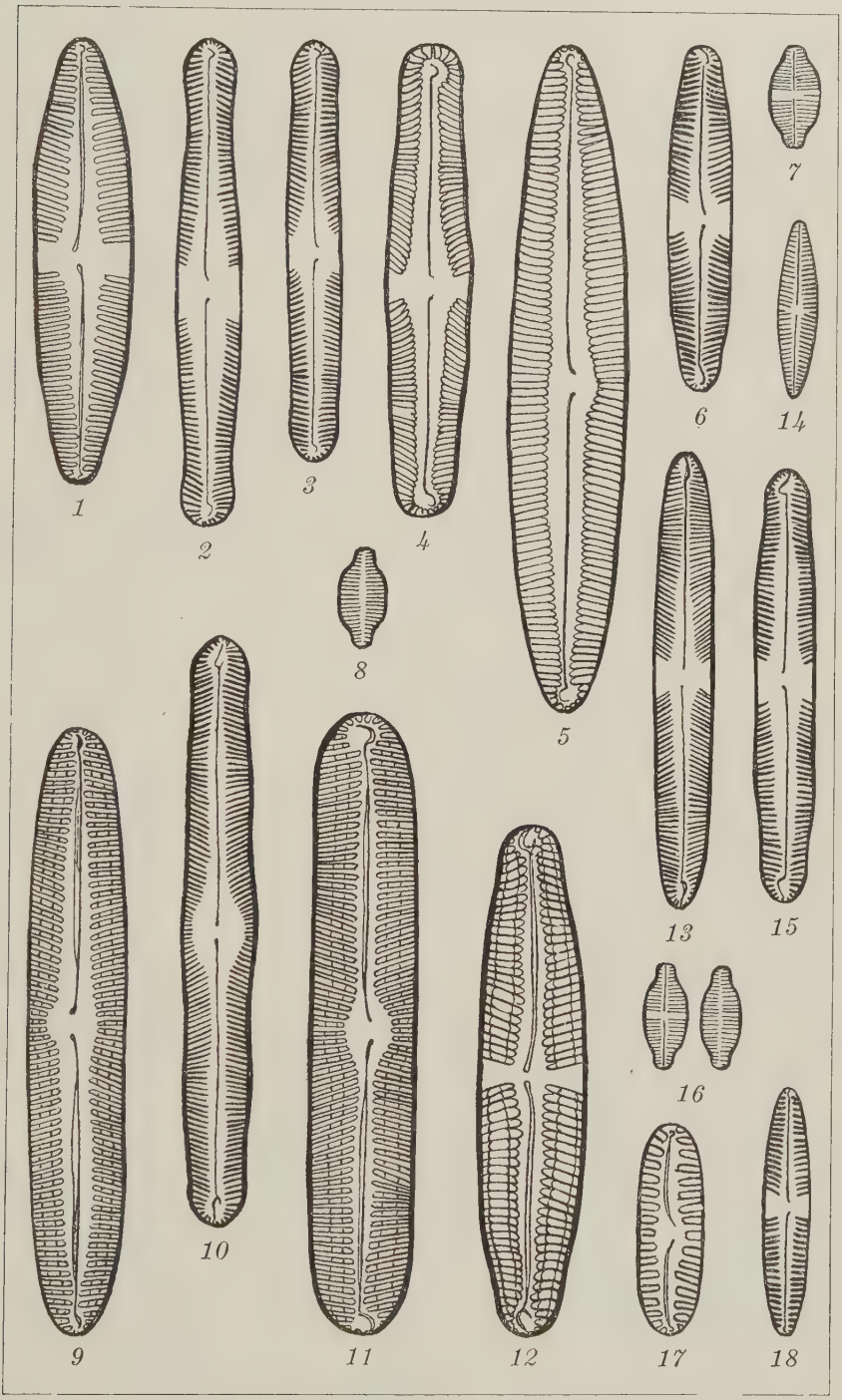

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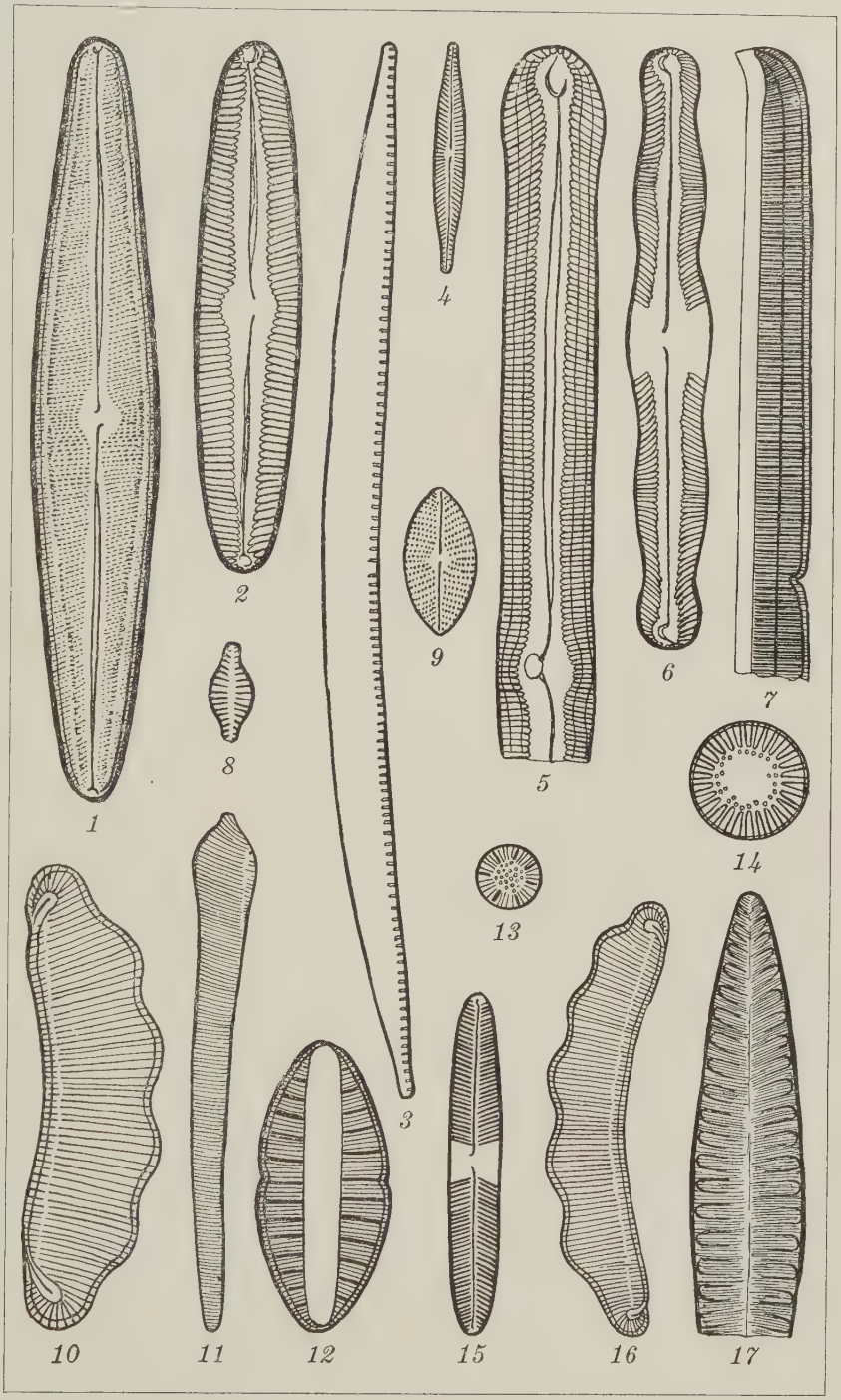

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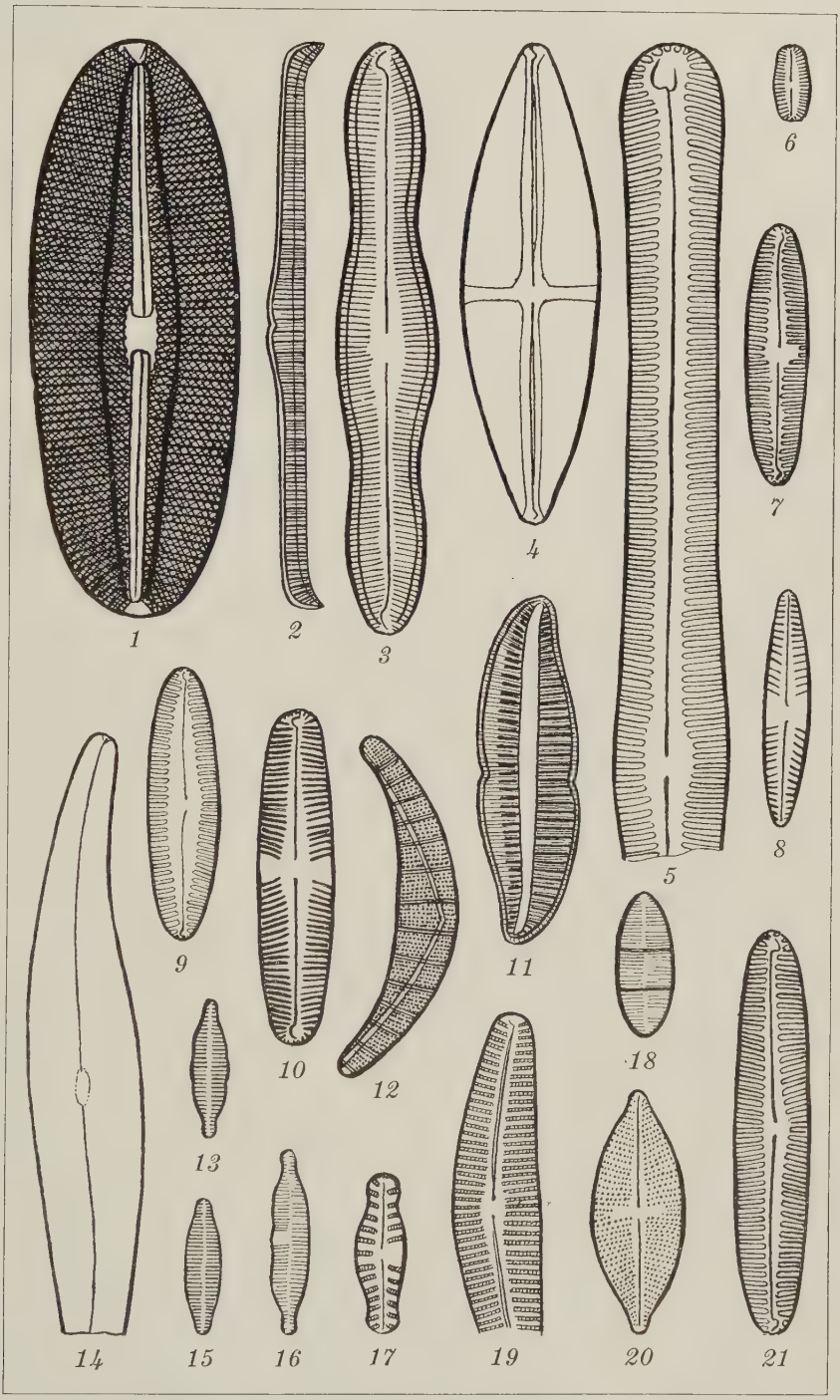

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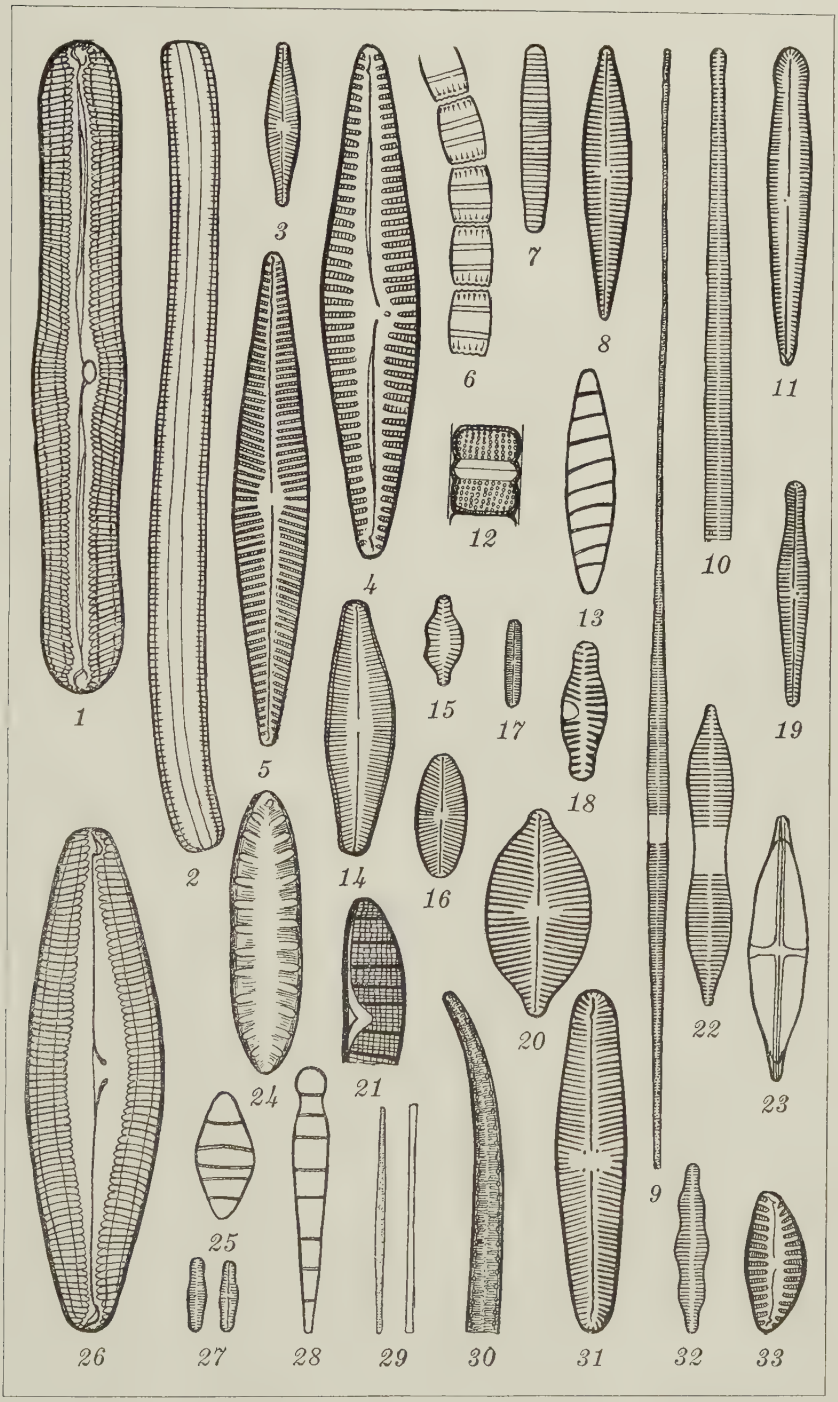
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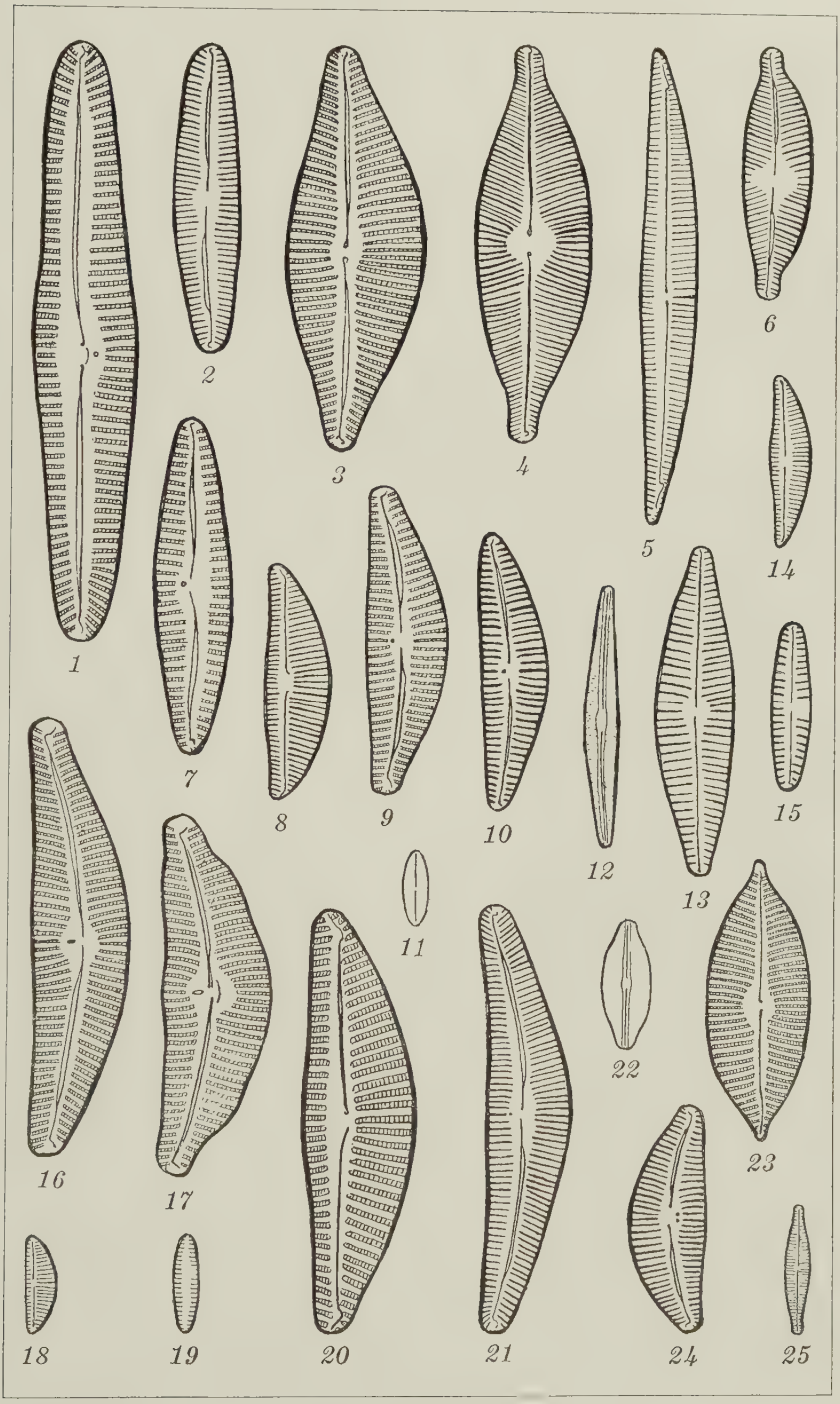
PLATE 10.



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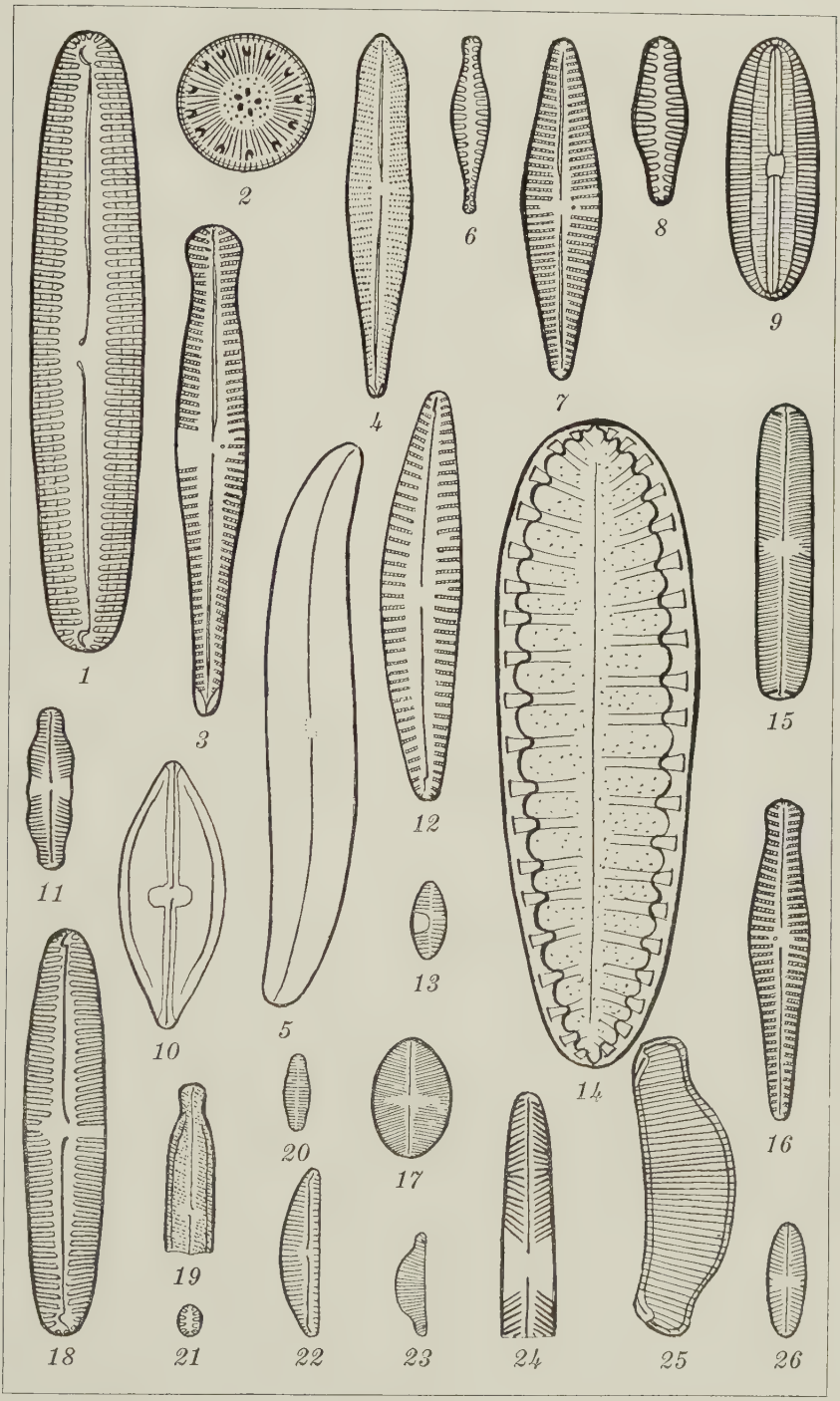

PLATE 12.

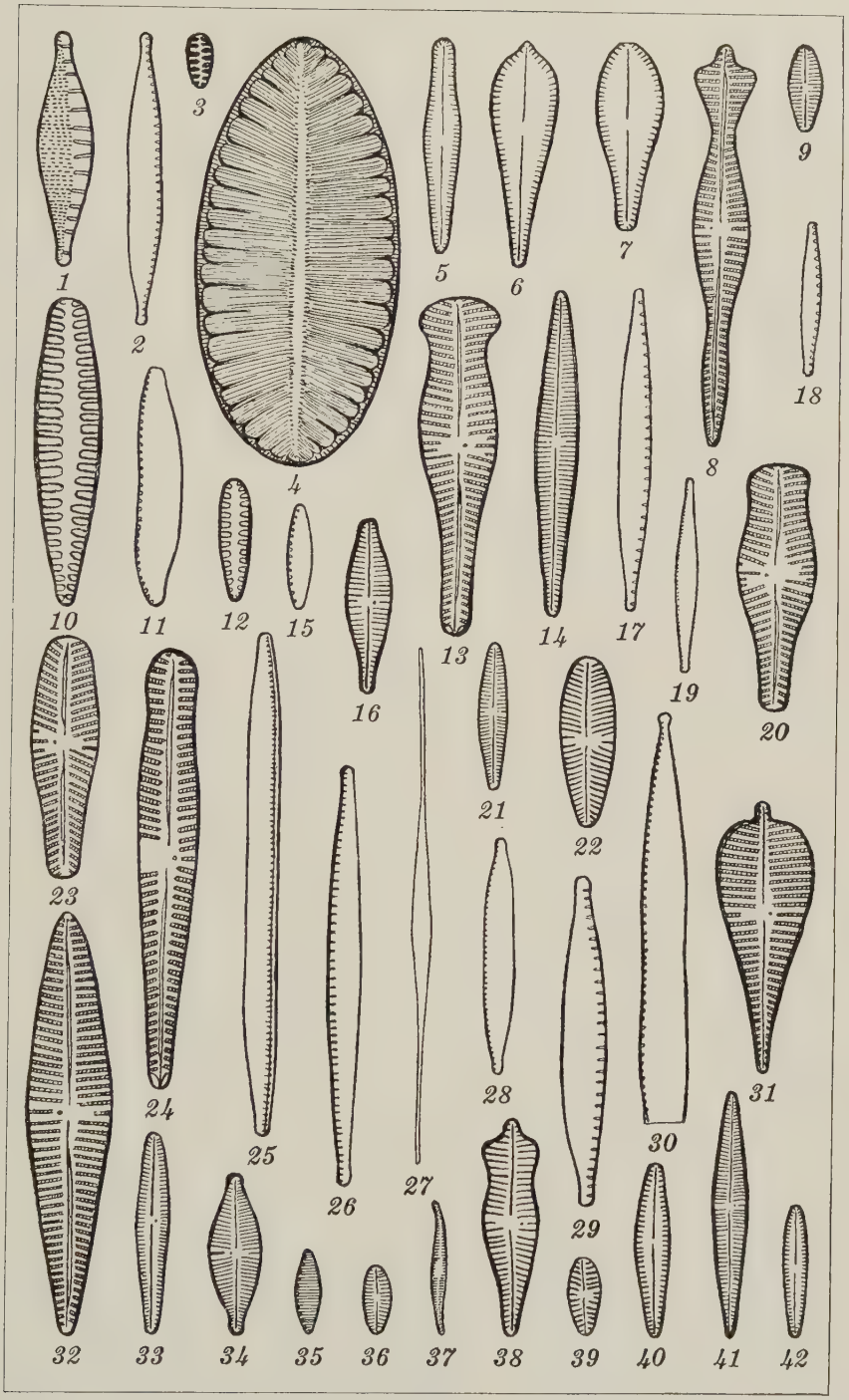
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PLATE 13.

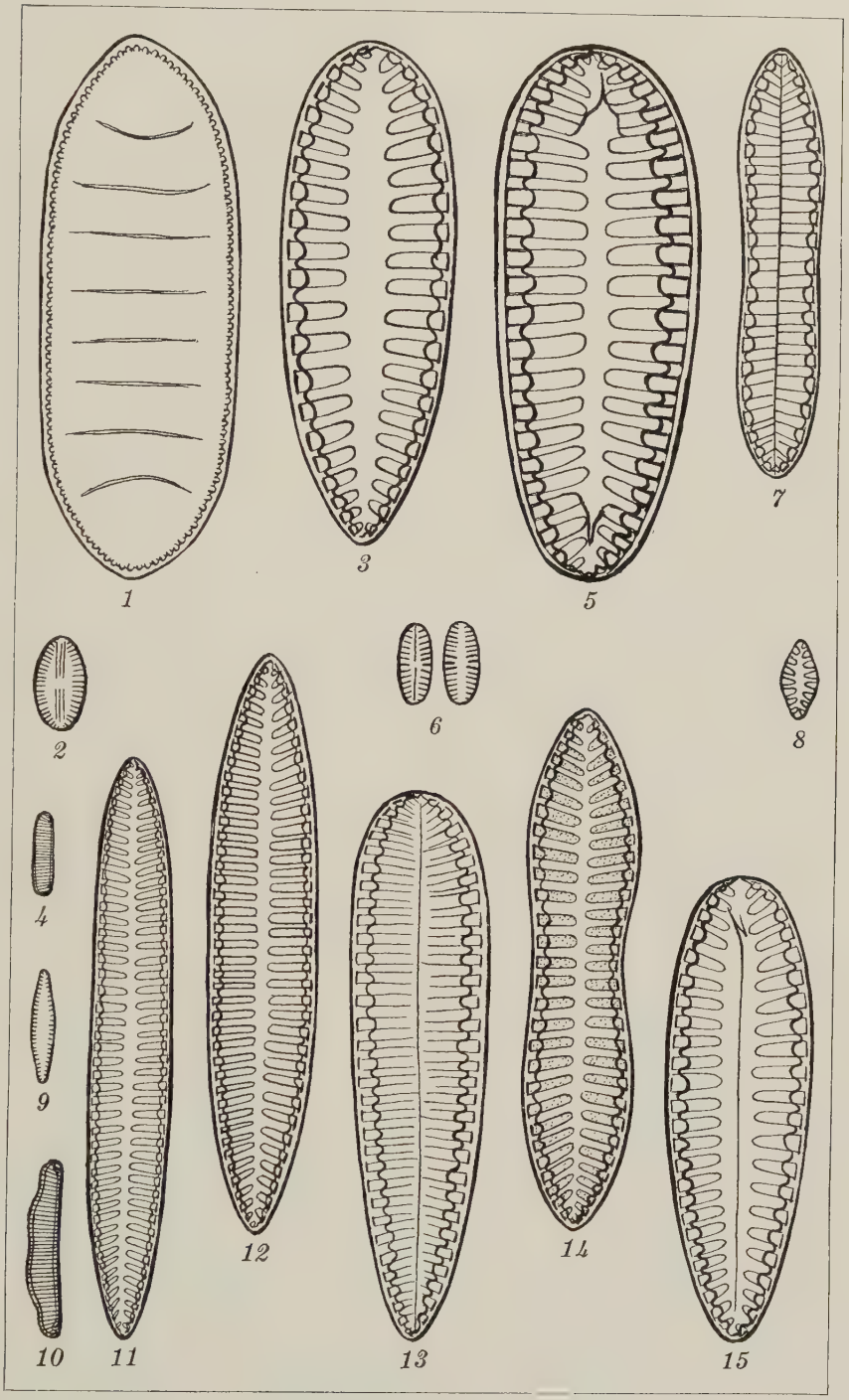

PLATE 14.

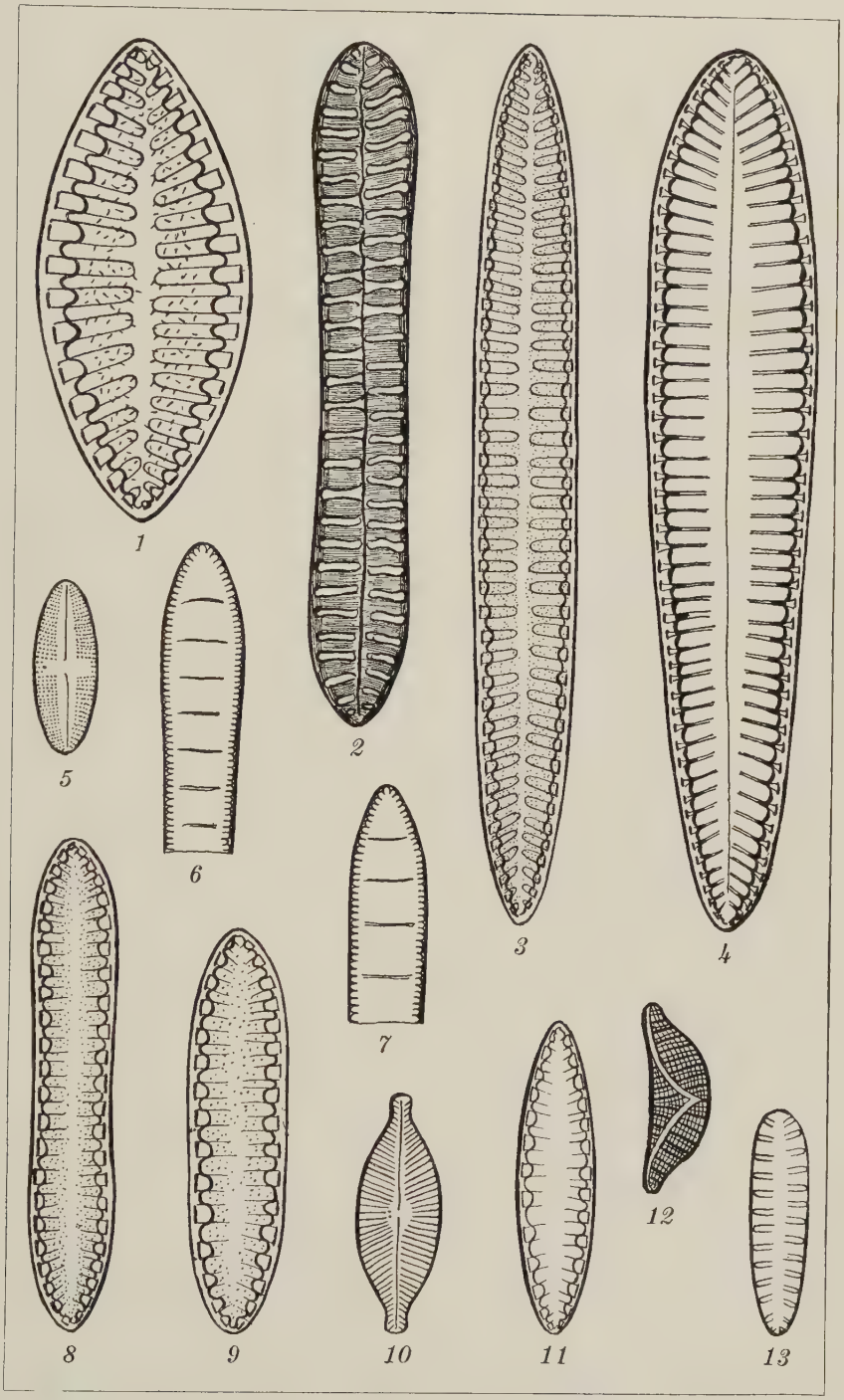

PLATE 15.

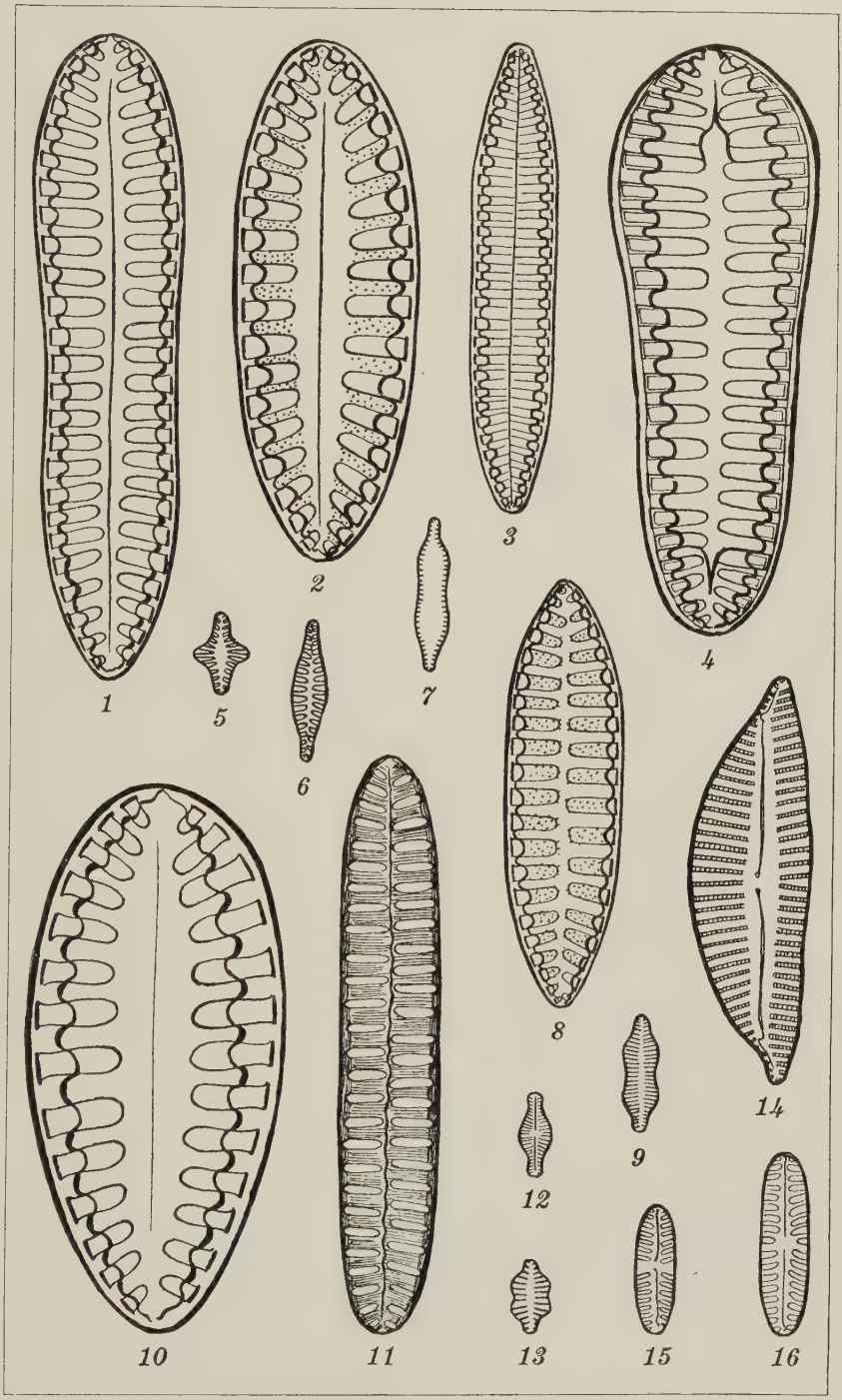

PLATE 16.

OÖCHORISTICA EXCELSA, A NEW REPTILIAN CESTODE

By MARCOS A. TUBANGUI and VICTORIA A. MASILUÑGAN
Of the Bureau of Science, Manila

ONE TEXT FIGURE

Two specimens of a new tapeworm were found in the intestine of a grass lizard, *Mabuia multifasciata.* Unfortunately, the head and neck are lacking in one of the specimens, for which reason a comparative study could not be made of these structures.

According to Meggitt (1934), the genus *Oöchoristica* (Luehe, 1898) includes twenty-five valid species, the other forms that have been described under the genus being either synonyms or members of closely related cestode genera. To these the following have recently been added: *Oöchoristica lygosomæ,* described by Burt (1933) from a lizard, *Lygosoma punctatum,* caught in Colombo, Ceylon; *O. thapari,* described by Johri (1934) from an Indian lizard, *Calotes* sp.; and *O. taborensis,* found by Loewen (1934) in the intestine of a bat in Kansas, United States. Compared with these known species and considering, according to Meggitt, the course of the genital ducts, the extent of the cirrus sac across the proglottis, and the arrangement of the testes as important characters in differentiating between the members of the genus, the Philippine parasite appears to bear the closest resemblance to *O. surinamensis* (Cohn, 1902), *O. fibrata* Meggitt, 1927, and *O. americana* Hardwood, 1932. It may be distinguished, however, from these three species by the smaller dimensions of its body, head, and cirrus pouch, its fewer testes, and the oval shape of the lobes of its ovary.

OÖCHORISTICA EXCELSA sp. nov. Text fig. 1.

Description.—Maximum length about 26 millimeters. Immature and mature segments much wider than long, gravid segments squarish but usually much longer than wide. Extreme measurements of available material gave the following results: Immature segments 0.030 to 0.072 by 0.24 to 0.35, mature segments 0.095 to 0.247 by 0.38 to 0.62, gravid segments 1.9 to 4.7 by 0.55 to 1.1 millimeters. Scolex unarmed, 0.25 millimeter in diameter, separated from the rest of the worm by a very

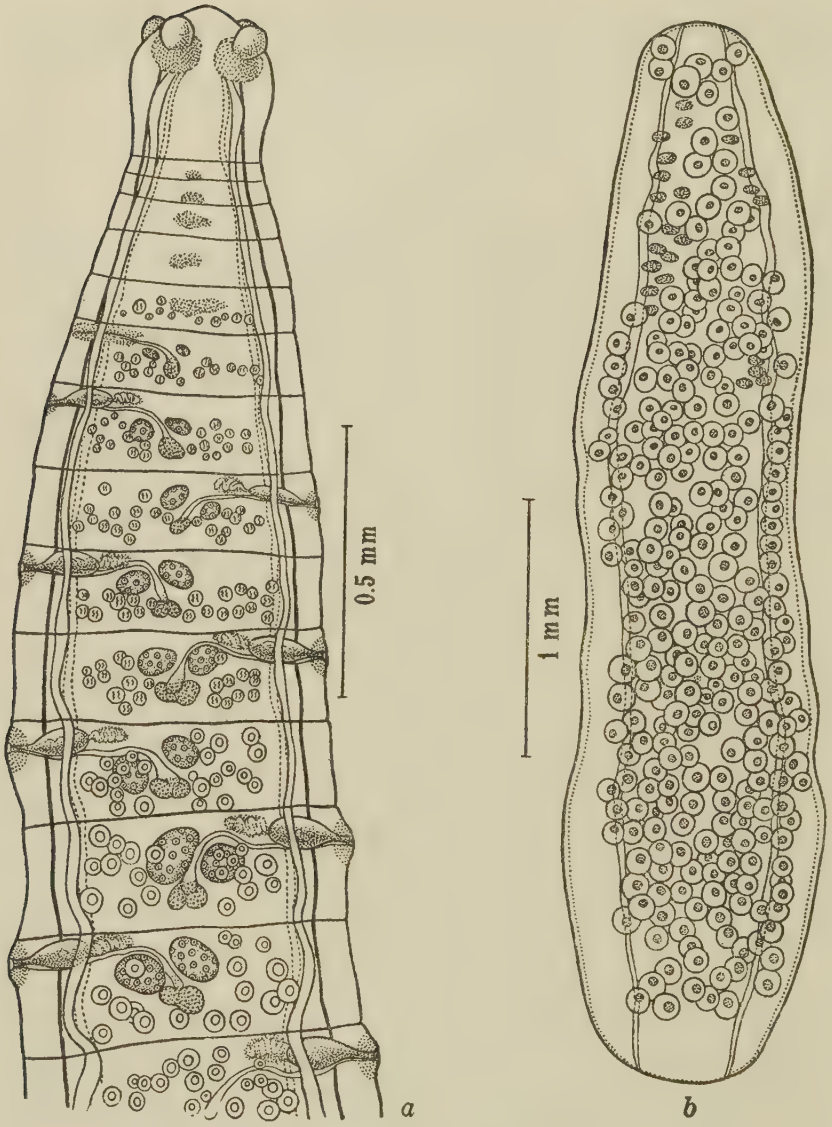

FIG. 1. *Oöchoristica excelsa* sp. nov.; *a*, anterior end of worm showing scolex and mature segments; *b*, a gravid segment.

short neck. Suckers 0.075 to 0.088 millimeter in diameter. Genital pores irregularly alternate, situated at posterior border of first third of lateral margins of mature proglottids; in gravid segments they occur at limit of anterior fourth or fifth of

margins. Genital cloaca absent. Genital ducts pass between principal longitudinal excretory vessels.

Male reproductive organs appear to attain maturity before those of the female genital system. Testes spherical, 23 to 29 in number, 19 to 30 microns in diameter, at posterior half of proglottis and extending anteriorly on both sides of median line to middle level of ovary; they are confined between longitudinal excretory vessels. Cirrus sac oval, 0.107 to 0.123 by 0.046 to 0.057 millimeter in size. In mature segments the cirrus sac extends mesially well past the longitudinal excretory vessels, while in gravid segments it does not pass beyond these vessels. Vas deferens short, in loose coils.

Ovary bilobed, immediately preëquatorial, displaced slightly towards poral side of segment; lobes oval, 0.030 to 0.073 by 0.050 to 0.096 millimeter in size. Vitelline gland median, composed of two wings, 0.053 to 0.084 millimeter across, immediately behind ovary. Shell gland small, between ovary and vitelline gland. Vagina opens into genital pore behind cirrus. A distinct receptaculum seminis present. Uterine sacs are first seen in eleventh or twelfth segment; a fully developed gravid segment contains at least 250 of these sacs or capsules, each inclosing a single ovum. Uterine capsules 84 to 107 microns in diameter, onchospheres 38 to 46 by 30 to 34 microns in size, and the embryonal hooks about 19 microns in length.

Specific diagnosis.—Oöchoristica: Maximum length 26, maximum breadth 1.1 millimeters. Scolex 0.25 millimeter across. Genital pores irregularly alternate, at limit of anterior third of lateral margins of mature segments; in gravid proglottids at limit of anterior fourth or fifth of margins. Genital cloaca absent. Cirrus sac 0.107 to 0.123 by 0.046 to 0.057 millimeter in size, in mature proglottids half-crossing longitudinal excretory vessels, in gravid segments extending only to vessels. Testes 23 to 29 in number, 19 to 30 microns in diameter, reaching anteriorly to middle level of ovary. Uterine capsules 84 to 107 microns in diameter, onchospheres 38 to 46 by 30 to 34 microns in size, embryonal hooks 19 microns in length.

Host.—Grass lizard, *Mabuia multifasciata.*

Location.—Intestine.

Locality.—Los Baños, Laguna Province, Luzon.

Type specimens.—Philippine Bureau of Science parasitological collection, No. 506.

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ILLUSTRATION

TEXT FIGURE

FIG. 1. *Oöchoristica excelsa* sp. nov.; *a*, anterior end of worm showing scolex and mature segments; *b*, a gravid segment.

DIE STAPHYLINIDEN DER PHILIPPINEN (GATTUNG OXYTELUS)[1]

Von Max Bernhauer

Öffentlicher Notar in Horn, Nieder-Österreich

Übersicht über die philippinischen Arten der Gattung Oxytelus.

1. Erstes Fühlerglied gegen die Spitze nicht erweitert ..... 2.
   Erstes Fühlerglied gegen die Spitze keulig erweitert ..... 8.
2. Augen fein facettiert: Untergattung *Tanycrærus* ..... 7.
   Augen grob facettiert: Untergattung *Caccoporus* ..... 3.
3. Halsschild mit deutlichen Längsfurchen ..... 4.
   Halsschild fast ohne Andeutung von Furchen. Einfarbig rötlichgelb, glänzend, fast unbehaart. Kopf so breit wie der Halsschild, mit sehr grossen, fast die ganzen Kopfseiten einnehmenden, ziemlich fein facettierten Augen, fein und weitläufig punktiert, ohne deutliche Eindrücke. Halsschild fast so breit wie die Flügeldecken, fast um die Hälfte breiter als lang, nach rückwärts geradlinig, etwas ausgeschweift verengt, längs der Mitte mit einer sehr feinen, undeutlichen Längsfurche, an den Seiten schwach niedergedrückt, fein und weitläufig, an den Seiten etwas dichter punktiert. Flügeldecken etwas länger als der Halsschild, fein und wenig dicht, etwas längsrissig punktiert. Abdomen fast unpunktiert. Länge: 2.5 mm. Manila ..... *æquicollis* sp. nov.
4. Die seitlichen Längseindrücke des Halsschildes lang, scharf und tief, die Mittelfurchen ebenfalls sehr tief und scharf. Molukken, Philippinen, Neu-Britanien ..... *fallax* Fauv.
   Die seitlichen Längseindrücke des Halsschildes mehr oder minder flach und undeutlich ..... 5.
5. Hinterleib mit durchgehender schwarzer Mittellinie, Halsschild ziemlich glänzend. Java ..... *ruptus* Fauv.
   Hinterleib ohne schwarzer Mittellinie ..... 6.
6. Körper grösser, Halsschild ziemlich matt, dicht längs gerunzelt. Über die indo-malayische Region weit verbreitet ..... *nigriceps* Kr.
   Körper kleiner, Halsschild glänzend, ziemlich weitläufig punktiert, kaum längsgestrichelt. Fast über die ganzen Tropen mit Ausnahme des afrikanischen Festlandes verbreitet (*ferrugineus* Kr.). *incisus* Motsch.
7. Körper klein, Färbung tiefschwarz mit hellgelben Flügeldecken, Halsschild an den Seiten ziemlich gleichmässig gerundet, mit abgerundeten Hinterecken. Über den grössten Teil der indo-malayischen und afrikanischen Region und Madagaskar verbreitet ..... *micans* Kr.
   Körper grösser, Halsschild rotgelb, nach rückwärts stark und mehr geradlinig verengt, mit sehr tiefen, schwarzen Furchen. *megaceros* var. *flavicollis* Bernh.

[1] 32. Beitrag zur indo-malayischen Staphyliniden-Fauna.

8. Kopf beim Männchen mit zwei Stacheln am Vorderrand. (Untergattung *Boettcherinus* nov.) ..... 28.
   Kopf beim Männchen am Vorderrand ohne Stacheln ..... 9.
9. Rückenfläche der Flügeldecken durch eine kräftige scharfe Längsfalte von den herabgebogenen Seiten begrenzt, Augen klein facettiert. (Untergattung *Emopotylus.*)

   Körper ziemlich gross, Halsschild fast mehr als doppelt so breit wie lang. Lebhaft rötlichgelb, der Kopf schwarz, die Flügeldecken geschwärzt, in sehr seltenen Fällen hell, die Tergite an der Basis mehr oder minder schmal geschwärzt, die Fühler rostbraun. Kopf beim Männchen fast so breit wie der Halsschild, beim Weibchen viel schmäler, stark quer, vorn stark eingedrückt, glänzend, hinten kräftig und dicht, beim Männchen längs gestrichelt, beim Weibchen mehr runzelig punktiert, die Schläfen beim Männchen nach rückwarts erweitert, viel länger als die Augen, beim Weibchen viel kürzer, nach hinten nicht erweitert. Fühler gegen die Spitze mässig verdickt, das vierte und fünfte Glied kugelig, die folgenden eine sechsgliedrige Keule bildend, die vorletzten um die Hälfte breiter als lang. Der Halsschild mindestens doppelt so breit wie lang, mit drei tiefen Längsfurchen und einem breiten Seiteneindruck, ziemlich kräftig und ziemlich weitläufig punktiert, glänzend. Flügeldecken etwas länger als der Halsschild, ziemlich stark und mässig dicht, hinten etwas längsrissig punktiert. Hinterleib fast unpunktiert. Länge: 4 bis 5 mm. LUZON, Los Baños. MINDANAO, Surigao und Momungan.

   nigripennis sp. nov.

   Rückenfläche der Flügeldecken ohne oder nur mit schwacher Begrenzungsfalte. (Untergattung *Anotylus.*) ..... 10.
10. Vorderkörper mehr oder minder glänzend und grob skulptiert, Grundfärbung hell ..... 11.
    Vorderkörper mehr oder minder matt, äusserst fein skulptiert, Grundfärbung meist schwarz ..... 23.
11. Halsschild mehr oder minder weitläufig oder nur mässig dicht punktiert ..... 12.
    Halsschild dicht punktiert oder gestrichelt ..... 17.
12. Flügeldecken einfach und sehr weitläufig punktiert. Körper grösser, 3 bis 4 mm ..... *bakeri* Bernh.
    Flügeldecken weniger weitläufig und kräftig längsgestrichelt ..... 13.
13. Körper grösser (3 mm) Kopf glänzend, nicht chagriniert.

    nitidifrons Woll.

    Körper kleiner (1.5 bis 2.5 mm), Kopf wenigstens beim Männchen teilweise matt chagriniert ..... 14.
14. Kopf beim Männchen sehr stark erweitert, zwischen den Augen äussert fein und ganz matt chagriniert ohne deutliche Punktierung, beim Weibchen glänzend, viel schmäler als der Halsschild. Einfarbig rötlichgelb, mit etwas dunklerem Kopf. Fühler ziemlich gestreckt, die vorletzten Glieder schwach quer. Halsschild um mehr als die Hälfte breiter als lang, verkehrt trapezförmig, mit drei tiefen Längsfurchen und je einem breiten Seiteneindruck, ziemlich kräftig und wenig dicht punktiert, glänzend. Flügeldecken etwas länger als der Halsschild, kräftig und dicht längsgerunzelt, wenig glänzend. Länge: 1.5 bis 2.5 mm. MINDORO, Subaan. LUZON, Mount Maquiling, Mount

Isarog, Imugan, Balbalan, Bayombong, Los Baños, Limay, Pagsanjan. MINDANAO, Surigao. BILIRAN ..... *hostilis* sp. nov.

Kopf beim Männchen weniger erweitert, zwischen den Augen deutlich punktiert ..... 15.

15. Halsschild namentlich an den Seiten dichter punktiert..... 16.

Halsschild überall sehr weitläufig punktiert. Dem *hostilis* sehr nahe verwandt und ihm in Gestalt und Färbung sehr ähnlich, durch viel weitläufigere Punktierung und besonders im männlichen Geschlecht durch weniger erweiterten und zwischen den Augen nicht matt chagrinierten, sondern ziemlich glänzenden, mässig fein und wenig dicht punktierten Kopf verschieden. Länge: 2.2 mm. LUZON, Pagsanjan. *pagsanjanensis* sp. nov.

16. Kopf zwischen den Augen matt chagriniert, mässig fein und mässig dicht punktiert, mit starker von der rückwärtigen Querfurche bis zum Stirneindruck gehender Längsfurche, Färbung wie bei den vorhergehenden beiden Arten. Länge: 2.2 mm. LUZON, Imugan. *sulciceps* sp. nov.

Kopf zwischen den Augen wenig chagriniert, wenig fein und ziemlich dicht punktiert, die Stirnfurche nach vorn verkürzt. In der Färbung kaum verschieden. Länge 2.2 mm. LUZON, Bangui. *mixtus* sp. nov.

17. Flügeldecken grob und dicht, höchstens hinten längsstreifig punktiert. ..... 18.

Flügeldecken wenig grob oder fein, bis zur Basis längsstreifig und kielförmig skulptiert ..... 19.

18. Halsschild und Flügeldecken sehr dicht punktiert, wenig glänzend. Rötlichbraun, der Hinterleib heller, Taster und Beine rötlichgelb, Fühler rostbraun. Kopf schmäler als der Halsschild, matt chagriniert, ohne deutliche Punktierung, der scharf begrenzte Stirneindruck spiegelblank. Halsschild um die Hälfte breiter als lang, mit den normalen Eindrücken, grob und sehr dicht längsrunzelig punktiert. Flügeldecken etwas länger als der Halsschild, grob und sehr dicht, teilweise längsrunzelig, an der Basis nahezu einfach punktiert. Länge: 2.5 mm. LUZON, Laguna, ein einziges Exemplar. *fortipennis* sp. nov.

Halsschild und Flügeldecken mässig dicht punktiert, stark glänzend, im übrigen kaum von dem vorigen verschieden. Länge: 2.5 mm. LUZON, Balbalan, ein einziges Exemplar..... *balbalanensis* sp. nov.

19. Kopf zwischen den Augen ganz matt chagriniert..... 20.

Kopf zwischen den Augen deutlich etwas seidenglänzend..... 21.

20. Halsschild nicht allzu dicht und stark punktiert, glänzend, Kopf ausserordentlich fein chagriniert, ohne jede weitere Skulptur. Einfarbig rötlichgelb, mit helleren Tastern und Beinen. Der Kopf beim Männchen mässig, beim Weibchen viel schmaler als der Halsschild, die Schläfen beim Männchen so lang, beim Weibchen viel kürzer als der Längsdurchmesser der Augen. Halsschild etwa um die Hälfte breiter als lang, ausser den normalen Eindrücken stark und mässig dicht gerunzelt-punktiert, glänzend. Flügeldecken mässig kräftig und nicht allzu dicht, in langen, schmalen Kiellinien längsgestreift, ziemlich glänzend. Länge: 2.3 bis 2.8 mm. LUZON, Laguna und Imugan ..... *sericeiceps* sp. nov.

Halsschild sehr dicht und fein punktiert, wenig glänzend, Kopf namentlich beim Männchen deutlich längsgestrichelt, Körper viel kleiner, Färbung dieselbe. Kopf beim Männchen fast breiter, beim Weibchen mässig schmaler als der Halsschild, die Schläfen beim Männchen fast doppelt so lang, beim Weibchen wenig kürzer als der Längsdurchmesser der Augen. Die Skulptur des Halsschildes und der Flügeldecken ist viel feiner und dichter, die Oberfläche mit geringem Glanze. Länge: 1.5 bis 1.8 mm. LUZON, Los Baños. SAMAR, Catbalogan. *cameroni* sp. nov.

21. Kopf chagriniert, wenig glänzend ..... 22.
Kopf ziemlich glänzend, einfach und tief punktiert. Düster rötlichgelb, Kopf und Fühler etwas dunkler. Kopf beim Männchen fast so breit wie der Halsschild, mit langen, parallelen Schläfen, beim Weibchen viel schmäler, mit kurzer Schläfen, Fühler mässig kurz, die vorletzten Fühlerglieder etwa um die Hälfte breiter als lang. Halsschild quer trapezförmig, um ein Drittel breiter als lang, ausser den normalen Eindrücken wenig kräftig und weitläufig, stellenweise fein längsrissig punktiert. Flügeldecken etwas länger als der Halsschild, ziemlich fein und mässig dicht längsrissig punktiert. Länge: 1.2 bis 1.4 mm. LUZON, Los Baños und Bayombong. *modestus* sp. nov.

22. Halsschild ziemlich stark längsgestreift, pechschwarz, die Taster und Beine rötlichgelb, die Fühler bräunlich mit heller Wurzel und Spitze. Kopf viel schmäler als der Halsschild (Weibchen) sehr fein chagriniert, an den Seiten deutlich längsrissig, mit Ausnahme des glänzenden Stirneindruckes wenig glänzend, Augen gross, die Schläfen ziemlich kurz, unmittelbar hinter den Augen in flachem Bogen schräg gegen den Hals verlaufend. Halsschild verkehrt trapezförmig, nicht ganz um die Hälfte breiter als lang, mit scharf rechteckigen Hinterecken, ausser den normalen, ziemlich tiefen Furchen kräftig, gegen die Mitte zu schwächer längsgestreift, ziemlich glänzend. Flügeldecken etwas länger als der Halsschild, ziemlich kräftig und ziemlich dicht längsgestreift, ohne eigentliche Punktierung. Länge: 2 mm. MINDANAO, Surigao. Ein einzelnes Exemplar..... *aciculatus* sp. nov.
Halsschild ausserordentlich fein längsgestreift, schmutziggelb, mässig glänzend, der Mund und die Beine rötlichgelb, die Fühler bränlich. Kopf beim Weibchen ähnlich wie bei der vorigen Art, jedoch mit stärker gerundeten Schläfen, beim Männchen viel breiter und grösser, fast so breit wie der Halsschild, mit parallelen, langen Schläfen, ausser dem glänzenden Stirneindruck äusserst fein und dicht chagriniert, ziemlich matt. Halsschild um die Hälfte breiter als lang, nach rückwärts mässig verengt, mit stumpfen Hinterecken, ausser den mässig tiefen, normalen Längseindrücken sehr fein und dicht längsgestreift, mässig glänzend. Flügeldecken ziemlich kräftig und ziemlich dicht längsrissig punktiert. Länge: 1.2 bis 2 mm. MINDANAO, Port Banga und Momungan. MINDORO, San Teodoro. SIARGAO, Dapa ..... *tenuistrigosus* sp. nov.

23. Halsschildkiele stark glänzend ..... *pygmaeus* Kr.
Halsschildkiele nicht oder kaum glänzend..... 24.

24. Kopf neben den Augen mit einer bis zur Einschnürung gehenden Längsfurche ..... *latiusculus* Kr.

25. Halsschild um ein Drittel breiter als lang ..... 26.
Halsschild um die Hälfte breiter als lang. Rötlichgelb, matt, die Flügeldecken etwas dunkler. Kopf beim Männchen so breit wie der Halsschild, mit langen Schläfen, nach hinten etwas erweitert, äusserst dicht chagriniert, beim Weibchen schmäler als der Halsschild, Schläfen kürzer. Halsschild verkehrt trapezförmig, äusserst dicht, matt chagriniert. Flügeldecken wenig länger als der Halsschild, ebenso dicht wie dieser, aber stärker chagriniert. Länge: 1.5 bis 2 mm. LUZON, Mount Maquiling. MINDORO, San Teodoro ..... *luzonicus* sp. nov.
26. Klypeus nicht glänzend, wie der übrige Kopf matt ..... *obscurus* Cam.
Klypeus mehr oder minder glänzend ..... 27.
27. Körper schwarz bis pechbraun, Flügeldecken gekörnt punktiert. *minutus* Cam.
Körper rötlichgelb, Flügeldecken dicht längsgestrichelt, Fühler, Taster und Beine etwas blasser. Kopf schmäler als der Halsschild (Weibchen) mit Ausnahme des Klypeus matt chagriniert. Halsschild verkehrt trapezförmig, etwas mehr als ein Drittel breiter als lang, matt chagriniert, die drei Halsschildfurchen ziemlich scharf, der Seiteneindruck deutlich. Flügeldecken länger als der Halsschild, dicht und deutlich längsgestreift. Länge: Kaum 1 mm. LUZON, Los Baños, ein einziges Weibchen ..... *liliputanus* sp. nov.
28. Vorderkörper matt ..... 29.
Vorderkörper mehr oder minder glänzend ..... 30.
29. Vorderkörper vollkommen glanzlos, Halsschild ohne Andeutung einer Mittelfurche, die Stacheln am Vorderrand der Stirn beim Männchen an der Spitze nach auswärts geschwungen. Schwarzbraun, die Wurzel der gebräunten Fühler und der Mund dunkler, die Beine heller rötlichgelb. Kopf beim Männchen fast breiter, beim Weibchen schmäler als der Halsschild, beim Männchen nach hinten erweitert, mit langen Schläfen, beim Weibchen wit kurzen, nach rückwarts verengten Schläfen, der Stirneindruck beim Männchen stark, beim Weibchen schwach glänzend. Die Fühler gegen die Spitze stark verdickt, die vorletzten Glieder stark quer, das erste Glied beim Männchen stark verdickt. Halsschild fast so breit wie die Flügeldecken, um die Hälfte breiter als lang, nach rückwärts stark verengt, die drei Mittelfurchen kaum angedeutet, die seitlichen Eindrücke deutlich. Die Flügeldecken matt chagriniert, bei gewisser Ansicht mit rötlichem Kupferschimmer, wenig länger als der Halsschild. Hinterleib glänzend, nur undeutlich punktiert. Länge: 1.5 bis 1.8 mm. LUZON, Los Baños und Mount Maquiling. MINDORO, San Teodoro. *planaticollis* sp. nov.
Vorderkörper mit sehr schwachem, aber immerhin wahrnehmbarem Fettschimmer, Halsschild mit deutlicher Mittelfurche, die Stacheln am Vorderrand der Stirn beim Männchen gerade. Färbung etwas weniger dunkel, die Flügeldecken an der Basis rötlichgelb. Kopf beim Männchen nicht breiter als der Halsschild, nach hinten kaum erweitert, beim Weibchen beträchtlich schmäler als der Halsschild mit kurzen Schläfen. Fühler kaum verschieden. Stirneindruck auch beim Weibchen deutlich glänzend und mit einem Höckerchen versehen. Halsschild fast noch kürzer, mit scharfen Hinterecken, vor

diesen unmerklich gebuchtet, die seitlichen Mittelfurchen gut angedeutet. Flügeldecken ohne Kupferglanz. Länge: 1 bis 2 mm. LUZON, Los Baños. MINDORO, San Teodoro..... *cornutus* sp. nov.

30. Halsschild stark glänzend, nicht oder nur weitläufig längsgestrichelt. 31.

Halsschild nur mässig glänzend, ziemlich dicht längsgestrichelt. Pechschwarz, die Fühler und Taster bräunlich, die Beine hellgelb beim Männchen: Kopf so breit wie der Halsschild, um ein Drittel breiter als lang, nach rückwärts backenartig erweitert, der Eindruck im vorderen Teil, sowie eine Mittelzone auf dem erhobenen Teil geglättet, stark glänzend, die Seiten neben den Augen stark chagriniert und hinter den Augen dicht längsgerunzelt. Die Fühler sind mässig verdickt, bis zum Hinterrand des Halsschildes reichend, die vorletzten Glieder um die Hälfte breiter als lang. Halsschild um die Hälfte breiter als lang, nach rückwärts stark verengt, vor den scharfen Hinterecken tief ausgeschweift, in der Mitte mit drei starken Furchen, seitlich mit einem flachen Eindruck, dicht längsrissig skulptiert, nur die beiden Kiele zwischen den Furchen geglättet. Flügeldecken länger als der Halsschild, stark quer, sehr dicht und kräftig längsgestreift, wie der Halsschild mässig glänzend. Hinterleib stark glänzend, kaum punktiert. Länge: 2.1 bis 2.5 mm. MINDANAO, Surigao ..... *militaris* sp. nov.

31. Halsschild an den Seiten weitläufig längsgestrichelt und mit einem ziemlich starken Eindruck. Schmutzig rötlichgelb, glänzend, der Hinterleib dunkler, die Wurzel der bräunlichen Fühler, die Taster und Beine blassgelb. Kopf so breit wie der Halsschild, mässig breiter als lang, hinter den Augen gerade, unmerklich erweitert, an den Seiten matt chagriniert, längs der breiten Mittelzone und der Stirneindruck geglättet. Fühler kurz, die vorletzten Glieder fast doppelt so breit wie lang. Halsschild fast so breit wie die Flügeldecken, stark quer, nach rückwärts stark verengt, mit geradlinigen Seiten und stumpfwinkeligen Hinterecken, mit tiefer Mittelfurche, vor der Basis mit zwei kleinen Furchen, seitlich fein und wenig dicht längsgestrichelt. Flügeldecken länger als der Halsschild, wenig dicht längsgestrichelt, glänzend. Hinterleib kaum punktiert. Länge: 1.5 mm. MINDORO, San Teodoro, ein einziges Männchen.

bispinosus sp. nov.

Halsschild an den Seiten ohne Strichelung. Dunkel rötlichgelb bis pechfarben, glänzend, die Fühlerwurzel, die Taster und Beine blassgelb. Kopf beim Männchen nicht oder kaum schmäler als der Halsschild, mit parallelen, den Augendurchmesser an Länge überragenden Schläfen, beim Weibchen viel schmäler als der Halsschild, nach rückwärts verengt, mit kurzen Schläfen, glänzend glatt, nur mit einzelnen Punkten, beim Männchen hinter den Augen äusserst fein chagriniert und zwischen den Augen ungemein fein, schwer sichtbar längsgestrichelt. Stirn beim Männchen nicht wie bei den vorherigen Arten mit zwei langen, geraden Stacheln an den Seiten, sondern mit zwei scharfen, dicht aneinanderliegenden Zähnchen in der Mitte des Vorderrandes. Fühler wie bei der vorigen Art. Halsschild beim Männchen stark, beim Weibchen mässig quer, verkehrt trapezförmig mit

stumpf verrundeten Hinterecken, längs der Mitte mit einer in der Regel in der hinteren Hälfte verkürzten, bisweilen jedoch durchgehenden tiefen Längsfurche, sonst fast ohne jede Skulptur, stark glänzend, ohne deutlichen Seiteneindruck. Flügeldecken etwas länger als der Halsschild, glänzend glatt, fast ohne jede Andeutung einer Punktierung. Von *Oxytelus uncifer* Fauv., dem die Art sehr nahe steht, unterscheidet sie sich durch das Fehlen der seitlichen Mittelfurchen und der Seitengruben am Halsschild und den Mangel der Flügeldeckenpunktierung. Länge: 2 bis 2.5 mm. LUZON, Los Baños und Mount Banahao. MINDANAO, Momungan und Port Banga.

bidentatus sp. nov.

NEW LONGICORN BEETLES FROM FORMOSA, III (COLEOPTERA: CERAMBYCIDÆ)

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Of the University of California, Berkeley

ONE PLATE

The following descriptions are based on material collected by the author during two trips to Formosa, in 1932 and 1934, respectively. Two of the forms herein described are interesting as being subspecifically related to more northern forms, from north-central China and the northern Loochoo Islands, respectively. Several of the other new species represent various new genera, some of which are apparently without very close affinities, and others have tropical Oriental relationships. The types are deposited in the United States National Museum, Washington, D. C., and in the California Academy of Sciences, San Francisco, those in the latter being unnumbered unique types on loan deposit. Types previously designated by the writer as "in the author's collection" are similarly deposited in the collection of the California Academy of Sciences. The author is indebted to Dr. E. C. Van Dyke and Mr. E. P. Van Duzee for use of material in the California Academy of Sciences.

CERAMBYCINI

Cerambyx minutum Gressitt [1] is a synonym of *Dymasius kisanus* Matsushita,[2] having been published one day later than the latter name. The type locality of *C. minutum,* "Kamikochi, Japan," is erroneous, and should have been Kisan, Formosa, the same as for *D. kisanus*. The author's specimen was received in 1932 from Y. Yano, the collector of Matsushita's material, but it was in an envelope with lepturids from Kamikochi. The carelessness of the above collector is further evidenced by the writer having seen lepturids from Kamikochi in collections sent to this country labeled as from Kisan, Formosa.

[1] Philip. Journ. Sci. 55: 379, published March 8, 1935.

[2] Trans. Nat. Hist. Soc. Formosa 26: 540, published March 7, 1935.

CALLICHROMINI

Genus AROMIA Serville, 1833

AROMIA FALDERMANNI subsp. INSULARIS Gressitt subsp. nov. Plate 1, fig. 1.

Large, handsome; body largely iridescent green or violet; head violet-black, greenish on frons and occiput; mandibles blue laterally; antennæ dull blackish apically, scape shiny lavender, blue, or green, the following three segments iridescent purplish blue; prothorax purplish blue with a large orange area on each side reaching from apex to near base and to two pairs of tubercles on each side of middle of disc, greenish and coppery below, the process bluish black; scutellum deep blue or green; elytra variable, greenish basally, remainder greenish purplish brown; legs purplish blue or greenish, tarsi testaceous; ventral surface dark greenish with purplish tinges.

Head broad; antennal supports high and close; frons small; genæ large; surface minutely punctulate, irregularly clothed with dark hairs. Antennæ slightly longer than body in male, three-fourths as long in female; third segment longest; fourth to tenth decreasing slightly, acute externally at apices. Prothorax broad, with a thick tubercle at each side, and six on disc: One behind middle of anterior margin, a pair near center and three posteriorly, outer posterior ones highest, subtransverse; surface with erect dark hairs, particularly on the purple area. Scutellum elongate-triangular, grooved. Elytra slightly narrowed, rounded apically, and microgranulose-punctate. Hind tibiæ compressed and sinuate; first segment of hind tarsus not quite as long as remaining united. Length, 34 to 46 millimeters; breadth, 9.5 to 12.5.

Holotype, male, No. 51424, United States National Museum; Bukai, central Formosa, altitude 1,400 meters, June 16, 1934; allotype, female, Hassenzan, Formosa, altitude 1,500 meters, June 24, 1934; paratopotype, male, June 15, five paratypes, Hori, Formosa, altitude 600 meters, June, 1934; and one paratype, male, Hinokiyama, northern Formosa, altitude 1,600 meters, July 16, 1934 (*Y. Izumi*) in the author's collection; one paratype, Hori, in the California Academy of Sciences.

Differs from *Aromia faldermanni* Saund.,[3] from northern China, as which the present form has already been recorded from Formosa, in being larger, in having the antennæ entirely dark, instead of orange on the latter seven segments, and in

[3] Trans. Ent. Soc. London II 2 4 (1850) 111, pl. 4, fig. 7.

having the orange portion of the prothorax separated into two spots, with the central portion violet, instead of extending completely across the dorsal surface. In *insularis* the vertex is more deeply, and narrowly, grooved, the prothorax is more constricted before the lateral tubercles, the posterior tubercle of each side of the disc is more pronounced, and the scutellum is narrower and more deeply grooved. Specimens from northern Formosa (Hinokiyama) differ slightly in having the scape and anterior pairs of legs more greenish than purple, and the elytra largely greenish; but the iridescent coloration in these forms is exceedingly variable.

Genus CHLORIDOLUM Thomson, 1864

CHLORIDOLUM LOOCHOOANUM subsp. TAIWANUM Gressitt subsp. nov. Plate 1, fig. 2.

Moderately small; elegant, bright green; antennæ violet-blue; legs steel-blue; pronotum bluish on disc; scutellum shiny, slightly bluish green; elytra frosted green, lighter on shoulders and along basal portion of suture, slightly darker on disc; mandibles black at apices; palpi testaceous, with apical segments of both pairs brown except at apex; ventral surface bright green, finely clothed with short silvery pile.

Head moderately punctured on occiput and behind eyes, more finely and sparsely on vertex, frons, and genæ, and finely and densely on mandibles; gular area transversely, and subocular areas sublongitudinally, corrugated; frons and vertex narrowly midlongitudinally sulcate to between eyes. Antennæ two and one-third times as long as body in male, one-third longer in female; scape thick, subacute ectoapically, grossly punctured, subobliquely grooved externally; fourth segment slightly shorter than third, last longest. Prothorax longer than breadth at base, laterally armed slightly behind middle with a blunt tubercle with a short, acute tip; disc transversely striolate near apex and base, transversely or obliquely so at sides, and longitudinally in middle, with the outer longitudinal striolæ diverging and incompletely meeting the lateral ones in a blue, punctured area on each side of center; underside transversely corrugated anteriorly, subvermiculose punctate posteriorly; area around lateral tubercles smooth. Scutellum triangular, subacute behind, longitudinally grooved, nearly impunctate. Elytra narrowed posteriorly; apices narrowed and obtusely angulate near suture; surface granulose, except along suture near scutellum where it is finely, transversely corrugated and shiny. Legs and ventral surface finely punctured. Length, 14.5 to 18 millimeters; breadth, 3 to 4.

Holotype, male, No. 51425, United States National Museum; Bukai, Formosa, altitude 1,400 meters, June 12, 1934; allotopotype, female, and six paratopotypes in the author's collection; one paratopotype in the California Academy of Sciences; all taken by the author, June 12 and 14.

Differs from *C. loochooanum* Gressitt,[4] from Amami-Oshima Island, in being smaller, in having the elytra green instead of bluish, only the central part of the disc of prothorax blue, the labrum green instead of black, the vertex lacking ridges and striolæ parallel to the median groove, the scutellum narrower and longitudinally grooved, the elytra more strongly narrowed and more acute apically, and the abdomen smoother.

MOLORCHINI

Genus KURARUA Gressitt novum

Narrow, elytra narrowed and slightly outwardly curved posteriorly, slightly abbreviated; antennæ with third segment minute, posterior seven segments long and thickened; eyes finely faceted and emarginate; anterior coxæ subconical, their cavities subacute externally, and apparently open behind; middle coxal cavities very narrowly open externally.

Head longer than broad, slightly broader than prothorax; neck narrowest immediately behind the eyes; eyes minutely faceted, prominent, very narrowly constricted behind the antennal insertions; the antennal supports broad, rounded; the vertex narrow, medially sulcate to middle of frons, with a row of punctures on each side; frons short and broad, an impunctate area at middle of apical margin and a pit at each side near clypeus; clypeus very broad basally, basal margin rather concave, apical margin slightly so; labrum transverse, very short; mandibles moderate, apices acute, sides densely punctate; palpi short, the last segment subelliptical; genæ short. Antennæ (male?) one-third longer than body, moderately thick, except for second to fourth segments; scape three times as long as broad, arched; second segment minute, longer than broad, thickened apically; third segment minute, no thicker than, and but twice as long as, second; fourth segment half again as long as third, subequal to scape; fifth segment large, as long as two preceding combined, apex broadened, external angle subacute; following segments similar and progressively slightly longer; apical segment longest, with the apical fifth narrowed; first four segments

[4] Pan-Pacific Entomol. 9: 163.

slightly shiny and punctate, following segments dull, covered with minute, recumbent, bristlelike hairs. Prothorax subcylindrical, two-fifths again as long as broad, narrower than elytra; base as broad as middle; apex slightly narrower; disk fairly even, moderately sparsely punctate. Scutellum minute and narrow, apical portion concave. Elytra narrow, broadest basally, constricted antemedially, slightly narrowed posteriorly, not quite reaching apex of abdomen; apices narrowed externally and rounded; surface with fairly dense shallow punctures. Anterior coxal cavities slightly rounded, broader than long, subacute externally, apparently open behind, moderately separated, the intercoxal process expanded and rounded posteriorly; middle coxal cavities extremely narrowly open to epimera; intercoxal process of mesosternum broad, reaching just beyond middle acetabula, its apex concave, receiving process of metasternum; metasternum swollen and fairly densely punctured; metepisternum large, swollen posteriorly. Abdomen with first segment nearly as long as following two combined; second to last segments subequal, the fourth shortest. Legs fine, femora pedunculate and apically clavate; hind tibiæ slightly arched; first tarsal segments slightly shorter than following two segments combined in anterior pair, subequal in second pair, and only slightly longer in hind pair.

Genotype.—Kurarua constrictipennis Gressitt sp. nov.

Range.—Formosa (southern tip).

This genus is doubtfully placed in the Molorchini because the anterior coxal cavities are seemingly opened behind and the middle coxal cavities are very narrowly open exteriorly. It differs from most of the genera in the tribe in the very short third and fourth antennal segments, the smooth prothorax and long elytra. It differs from *Kunbir* in its much narrower form, longer and different antennæ and prothorax, and more suddenly, and more briefly, clavate hind femora.

KURARUA CONSTRICTIPENNIS Gressitt sp. nov. Plate 1, fig. 5.

Black, prothorax (except anterior margin) and forelegs red; elytra reddish brown basally and grayish brown on apical two-thirds. Body clothed with reddish brown hairs above and whitish hairs below.

Moderately small, narrow; prothorax long and plain; elytra constricted antemedially, narrower and divergent posteriorly, not quite reaching apex of abdomen; antennæ slightly longer than body, third segment minute, only twice as long as second, and two-thirds as long as fourth, the latter equal to scape, fol-

lowing segments long and thick, slightly flattened; legs fine, femora pedunculate and clavate, hind pair barely so for apical third. Length, 9.2 millimeters; breadth, 1.8.

Holotype, male (?), California Academy of Sciences; Kuraru, Koshun, near South Cape, Formosa, altitude 140 meters, April 10, 1932, taken by the author.

This species superficially resembles *Cleomenida setigera* Schw. in appearance, because of its narrow form, red thorax, and clavate femora, but is easily distinguished by its peculiar antennæ, more cylindrical prothorax, and narrowed elytra.

Genus MERIONŒDA Pascoe, 1858

Matsushita[5] has synonymized *Merionœda uraiensis* Kano[6] with *M. formosana* Heller[7] and Mitono[8] has followed him. These species, however, are quite distinct. The two may be distinguished as follows:

Eighth and ninth antennal segments one-fourth as broad as long; middle femora clavate for less than apical half; hind femora clavate for only apical third, the club narrower than head; tibial spines inclined. *M. uraiensis* Kano (fig. 6).

Eighth and ninth antennal segments half as broad as long; middle femora clavate for their apical half; hind femora clavate for nearly their apical half, the club as broad as the head; tibial spine subperpendicular ..... *M. formosana* Heller (fig. 7).

CLYTINI

Genus XYLOTRECHUS Chevrolat, 1860

XYLOTRECHUS RUFONOTATUS Gressitt sp. nov. Plate 1, fig. 9.

Moderately small, narrow, attenuated posteriorly; body black, except for an orange-red pronotal spot centered slightly before middle of disc; surface densely clothed above with green pile, paler on scutellum, and below with greenish gray, paler at the sides; antennæ basally with sparse, fine, greenish hairs, apically with microscopic recumbent hairs; legs sparsely clothed with suberect, and some longer erect, pale hairs.

Head abbreviated below; surface granulose punctate, with some large punctures below eyes; vertex and frons with a pair of approximate carinæ, converging at each end, on middle of vertex, and lower part of frons; frons narrow, subparallel, very slightly narrowed in middle, lateral carinæ obscure; eyes

[5] Journ. Fac. Agr. Hokkaido Imp. Univ. 34 2 (1933) 229.
[6] Ins. Matsumuriana 5 (1930) 43, fig. 1.
[7] Ent. Blätt. 20 1 (1924) 32.
[8] Mushi 8 1 (1935) 53.

inverted comma-shaped; palpi fine, apical segments twice as long as broad, rounded-truncate, not broadened, apically. Antennæ (female) short, fine, thickened apically; scape over twice as long as second segment and slightly longer than third; fourth and fifth subequal, each slightly shorter than third; following decreasing; tenth hardly longer than its diameter. Prothorax longer than broad, subcylindrical, only slightly swollen at sides; apex nearly as broad as base; disc somewhat raised postmedially, surface densely and fairly heavily punctured, some very large shallow punctures at sides. Scutellum rounded, less than twice as broad as long. Elytra slightly broader than prothorax, not quite twice as long as head and prothorax united, gradually narrowed posteriorly; apices subtransversely truncate, a very short tooth at sutural angle; surface densely and finely punctured. Metepisternum very narrow, apparently broader posteriorly. Legs with femora only slightly swollen; middle femora most heavily punctured; hind femora slightly exceeding elytral apices; first segment of hind tarsus two and one-half times as long as following two united. Length, 11.5 millimeters; breadth, 2.8.

Holotype, female, a unique, California Academy of Sciences; Hassenzan, Formosa, altitude 1,800 meters, June 21, 1932; taken by the author.

Differs from *X. cinerascens* Matsushita in its smaller size, more parallel and less prominently carinate frons, the two sides of the narrowly elliptic carinæ very close, the prothorax more cylindrical, the scutellum narrower, and the first segment of hind tarsus relatively shorter.

Genus PERISSUS Chevrolat, 1863

PERISSUS GRISEUS Gressitt sp. nov. Plate 1, fig. 8.

Small, abbreviated, subparallel; body black, fairly well clothed with pale greenish gray pubescence, whitish on sides of hind margin of prothorax and undersurface of body, where it is denser on sides of meso- and metathorax; body also with many erect pale hairs, except on tarsi and posterior three-fourths of elytra; antennæ with some moderate hairs on scape and a few projecting ones on inner side of following four segments, besides very fine pubescence covering their entire surface.

Head wider than high in front; finely punctured, with some large punctures on occiput and genæ; antennal insertions moderately distant, hardly raised; vertex plain; eyes inverted comma-shaped, deeply constricted; frons nearly as broad as long;

clypeus glabrous apically, apical palpal segments subtransversely truncate. Antennæ (female) hardly over half body length, somewhat thickened apically; scape as long as second and third segments combined; fourth shorter than third, equal to following; latter few, slightly shorter. Prothorax subcylindrical, no longer than broad, slightly broader at apex than base, slightly swollen at sides; granulose-punctate above. Scutellum short, broad, and rounded. Elytra twice as long as head and prothorax united, broader than prothorax, slightly narrowed posteriorly, separately narrowed and subobliquely truncate at apices; surface minutely granulose-punctate. Legs fine; hind femora and tibiæ sinuate, the femora reaching just beyond elytral apices; first segment of hind tarsus barely twice as long as following two segments united. Length, 8 millimeters; breadth, 21.

Holotype, female, a unique, California Academy of Sciences; Taiheizan, Formosa, altitude 1,600 meters, May 10, 1932; taken by the author.

Differs from *P. kankauensis* Schwarzer and the other species of the genus in lacking spots or fasciæ. The head is very short in front, the prothorax short and the scutellum broad.

Genus RAPHUMA Pascoe, 1858

RAPHUMA NOTABILOIDES Gressitt sp. nov. Plate 1, fig. 4.

Large, cylindrical, subparallel; body black, densely clothed with green or gray pubescence, paler beneath and nearly white at sides, marked with black as follows: A transverse suboval black spot on each side of middle of disc of prothorax, elytra with the external margins narrowly so for most of their length, each with a straight longitudinal stripe from humerus to end of first third, a line curving out from behind scutellum, extending posteriorly, then transversely outward, joining end of humeral stripe, next a fairly large irregular median spot, touching margin but not suture, and finally a large, free, subcircular spot, one-fourth from apex; antennæ clothed with fine, adpressed, greenish gray hairs; some suberect brownish hairs on underside of third and fourth segments; legs with the fine hairs goldish on tarsi, some brownish spinelike hairs on undersides of femora and tibiæ.

Head strongly punctured on either side of occiput and below eyes; eyes large, distant; frons slightly longer than broad, narrowed basally. Antennæ five-sixths as long as body in male, four-fifths in female; third segment longer than scape; fifth to seventh subequal, each longer than fourth and shorter than

third; remaining shorter; seventh to tenth broadened externally at apices. Prothorax broadest behind middle, narrowed apically; surface finely granulose. Scutellum rounded behind. Elytra slightly broader than prothorax, less than twice as long as anterior part of body; apices subobliquely truncate, dentate at both angles. Legs fairly fine; hind tarsi with first segment twice as long as following two united. Length, 17 to 20 millimeters; breadth, 4 to 4.5.

Holotype, male, No. 51426, United States National Museum; Sakahen, eastern Formosa (southwest of Karenko), altitude 1,350 meters, July 13, 1934, two paratopotypes and a female doubtfully referred to this species, Hassenzan, Formosa, altitude 1,400 meters, June 23, 1934, in the author's collection; all taken by the author.

This species is very similar in size and markings to *Chlorophorus notabilis* Pascoe, and quite probably represents the form recorded from Formosa as that species. It differs from the latter in having the antennæ much finer, with the third segment longer than the first, the pronotum smoother, and the legs much finer, with the first tarsal segment much longer. Differs from *Raphuma virens* Matsushita in its much larger size, more sulphurous coloration, more swollen prothoracic disc, and relatively longer third antennal segment and first hind tarsal segment. One of the paratopotypes is gray instead of yellowish green, with the markings less distinct. The specimen from Hassenzan is entirely gray.

Genus DEMONAX Thomson, 1860

DEMONAX MATSUSHITAI Gressitt sp. nov. Plate 1, fig. 10.

Small, narrow, parallel; black, clothed with gray pubescence; elytra with three pairs of dull black fasciæ, the first consisting of a narrow oblique line from suture just behind scutellum to middle of disc, one-fifth from base, and a curved humeral line which nearly meets the former at its apex, second a moderately broad suboblique band slightly before middle, reaching from suture to margin, narrower anteriorly near suture, third transverse, wide, one-fourth from the apex, slightly constricted at the suture, all the bands with a few intermixed gray hairs and their margins indefinite, scutellum and undersides of pro- and mesothorax whitish gray; some suberect pale hairs on legs and undersurfaces of basal antennal segments and apices of following segments.

Head small, as deep as wide; occiput with some large punctures at sides; eyes distant, deeply emarginate; vertex concave; antennal supports subacute internally; frons longer than broad, broader apically. Antennæ nearly as long as body in male, reaching to last quarter of elytra in female; scape not swollen apically, twice as long as second segment; third nearly half again as long as scape and fourth; fifth longer than fourth and following; third and fourth each with an apical spine one-fourth as long as the following segment, that of the fourth the longer. Prothorax one-fourth longer than broad, and very briefly constricted at apex and base; sides moderately swollen; surface shallowly reticulate-punctate with a few deeper punctures posterolaterally. Scutellum narrowly rounded behind. Elytra slightly broader than prothorax, parallel; apices transversely subsinuate-truncate, external angles minutely toothed. Legs fine; hind femora hardly swollen; hind tarsi shorter than tibiæ, first segment nearly twice as long as remaining united. Length, 8.5 millimeters.

Holotype, female, No. 51427, United States National Museum; Hassenzan, Formosa, altitude 1,800 meters, June 24, 1934; and paratopotype, male, in the author's collection, taken the same day.

Differs from *D. sauteri* Matsushita in its slightly larger size, more briefly spined third and fourth antennal segments, and narrower elytral bands, the first extending obliquely from behind scutellum beside another on humerus. Named in honor of Mr. Masaki Matsushita, of Toyohara.

Genus CHLOROPHORUS Chevrolat, 1863

CHLOROPHORUS DEMONACOIDES Gressitt sp. nov. Plate 1, fig. 11.

Laterally compressed, slightly narrowed behind; body black, orange at either side of scutellum, largely clothed with pubescence: head and antennæ sparsely clothed with gray; prothorax largely clothed with grayish green, greenish yellow at each side of basal margin and greenish white beneath; scutellum densely clothed with pale yellow; elytra black, slightly yellowish on basal margin and crossed by fasciæ of greenish yellow, the first extending obliquely from suture slightly behind scutellum to one-third from base, where it turns exteriorly and somewhat anteriorly, not reaching margin, the second transverse, two-thirds from base, broad at suture, narrowing laterally, not

reaching margins, its hind margin straight, the third an oblique apical spot bounded by a line from suture, halfway between second band and apex, to external apical angle, black portions with some adpressed bronzy hairs visible in certain lights; ventral surface grayish below and yellowish at sides; legs moderately clothed with reclining, and a few erect, hairs; some erect pale hairs on head, underside and bases of prothorax, and elytra; antennæ with some internal hairs fused to form false, subapical spines on most of the segments.

Head deep, hardly broader than apex of prothorax, heavily punctured, a few larger and shallower punctures on sides of occiput; antennal insertions distant; frons twice as high as wide, slightly broader apically, a low median carina extending most of its length; genæ fairly long; apical palpal segments broadened and subobliquely truncate apically. Antennæ (female) fine, just over half as long as body; scape small, three times as long as second segment, equal to third; fifth just longer than fourth, shorter than third; remaining shorter than fourth, successively diminishing in length. Prothorax one-fourth longer than broad, hardly narrower at apex than at base, only slightly swollen at sides; surface granulose. Scutellum broadly scutiform. Elytra not quite twice as long as head and prothorax united, slightly broader than prothorax, moderately narrowed posteriorly; transversely subsinuate-truncate apically; base swollen in middle; surface finely punctate. Ventral surface fairly densely and fine-punctured; visible portion of metepisternum hardly broader anteriorly than posteriorly. Legs fairly long, the hind femora extending one-fifth their length beyond elytral apices; middle femora very heavily punctured; hind tarsi with first segment nearly half again as long as remaining united. Length, 12 millimeters; breadth, 3.

Holotype, female, a unique, California Academy of Sciences; Suisha, by Lake Candidius, central Formosa, altitude 750 meters, May 31, 1934.

This species is not closely related to any other species of the genus known to me. It differs structurally from *C. signaticollis* Chevr. in having the head longer, the antennæ finer, more distantly inserted, and with false subapical spines, the prothorax narrower, the scutellum smaller and the hind legs longer; it is very similar in markings to large specimens of *Perissus kankauensis* Schwarzer. Possibly this species should be placed in

Demonax, because the antennal insertions are rather distant, but the spines on the inner sides of antennal segments are composed of groups of hairs instead of extensions of the segments, and furthermore, the third antennal segment is not longer than the scape.

CHLOROPHORUS MIWAI Gressitt sp. nov. Plate 1, fig. 12.

Cylindrical, parallel; black, largely clothed with dense green pubescence; head and antennæ green; prothorax green, with a black spot on each side, and a wide, inverted Y-shaped black marking on disc; scutellum green; elytra green, marked with three sets of fasciæ: The first a zerolike mark on basal portion, not touching suture, barely touching base, and with a short extension along external margin; the second a wide, transverse band at middle, nearly straight behind, and extending anteriorly some distance along suture, another anterior extension joining hind part of zerolike mark at side; the last a large, squarish spot in last third, free from suture and apex, but touching margin; ventral surface clothed with paler green, nearly white on the pleura; legs sparsely clothed with grayish green.

Head higher than wide; frons squarish; eyes inverted comma-shaped; antennal insertions fairly close; occiput heavily punctured on sides. Antennæ (female) slightly more than half as long as body; scape slightly arched, barely longer than third segment; fourth slightly shorter than third; following gradually decreasing; most of the segments with a row of fine setæ below. Prothorax subglobular, slightly longer than broad, narrower at apex than base. Scutellum slightly narrowed, rounded at apex. Elytra fairly long, slightly narrowed; apices obliquely truncate; hardly toothed at either angle. Legs fairly fine; hind tibiæ fairly prominently spined internally at apex; hind tarsi with first segment as long as remaining united. Length, 15 to 15.5 millimeters; breadth, 3.6.

Holotype, female, United States National Museum; Rarasan, northern Formosa, altitude 1,750 meters, July 23, 1934; paratype, female, in the author's collection, Hori, Formosa, July, 1934; paratype, male, Tai Kwong, Lam Mo district, Hunan Province, China, July 26 to 28, 1934 (F. K. To), in the collection of the Lingnan Natural History Survey and Museum, Canton.

Very similar to *C. varius,* of Europe, and *C. dubius* Matsushita, of Formosa, differing from both in having the elytra longer, the

pubescence green instead of yellowish gray or whitish gray, the discal marking of prothorax different, and other characters.

STENASPINI

Genus BUNOTHORAX Gressitt novum

Body strongly compressed dorsoventrally, antennæ with basal segments tufted; prothorax 11-noded; elytra tricarinate; legs short.

Head abbreviated anteriorly; frons short, vertical; vertex broad, concave, grooved medially; occiput smooth, impunctate; eyes deeply constricted, moderately finely faceted, closely approaching mandibles; genæ minute; palpi short, apical segments compressed, truncate apically. Antennæ (male) half again as long as body, first six segments heavily clothed with long black bristles on apical half, following segments with only a few hairs; scape strongly thickened, shorter than third segment; second longer than broad; third and fourth equal, each slightly shorter than fifth to tenth, which are subequal; last twice as long as third; fourth to ninth subangulate externally at apices. Prothorax nearly twice as broad as long; disc with nine more or less rounded tubercles, one at each side near anterior margin, a pair just before middle, one behind center and two at each side near hind margin; each side also with a strong, blunt tubercle; some large, irregular punctures between, or on sides of, tubercles; surface furnished with long black bristles, as on head. Scutellum equilaterally triangular, subacute, concave basally. Elytra separately produced anteriorly at middle of base; narrow basally, hardly broader than prothorax, very slightly broadened posteriorly, rounded apically; disc with three strongly raised lines, another weaker one between outer two; surface densely and grossly punctate, reticulate, glabrous, a few short black hairs along posterior portions of outer margin. Prosternal process rounded, prominent; mesosternal process narrow, squarish in lateral outline, slightly more prominent anteriorly; middle coxal cavities open externally. Legs short; first segment of hind tarsi less than twice length of second.

Genotype.—Sternoplistes takasagoensis Kano.

Range.—Formosa.

This genus differs from *Sternoplistes* Guer. in having a much flatter body, shorter, tuberculate prothorax, plumed antennæ, more strongly carinate and punctate, and more glabrous, elytra, longer pro- and mesosternal tubercles, and shorter legs.

BUNOTHORAX TAKASAGOENSIS (Kano). Plate 1, fig. 3.

Sternoplistes takasagoensis KANO, Kontyu (Tokyo) 6 (1933) 278.

Body black, elytra bright red; basal antennal segments with tufts of posteriorly directed black bristles; head and prothorax with erect black bristles; prothorax shiny, with eleven rounded tubercles; elytra nearly naked, strongly punctured and ribbed. Length, 13 to 16 millimeters.

Distribution.—Formosa, Arisan (type locality); Taiheizan, a male in the author's collection, June, 1934.

MESOSINI

Genus SAIMIA Pascoe, 1866

(?) SAIMIA HIRTICORNIS Gressitt sp. nov. Plate 1, fig. 13.

Moderately narrowed, subparallel; antennæ very hairy posteriorly. Body black, clothed with pubescence of mottled gray-brown, marked with brown, light gray, and ochraceous; head incompletely clothed with pale buff, mottled with darker in front and with a pair of longitudinal dark brown stripes on occiput, and another behind each upper eye lobe; antennæ with scape gray, the following segments pale gray basally and black apically, apical segments largely black, long internal hairs similarly colored, longer and denser posteriorly; prothorax gray-brown, spotted anteriorly with ochraceous and with four indistinct dark stripes on disc; elytra whitish gray, dotted with black punctures, crossed by two irregular brown fasciæ, one behind base, the other behind middle, and spotted irregular with ochraceous; undersurfaces densely clothed with gray and ochraceous, reddish on posterior margins of abdominal segments, also some flying gray hairs; legs brown and buff; tarsi with first, second, and last segments light gray basally, black apically, the third entirely black.

Head sparsely punctured; eyes small, the two lobes connected by a fine line; frons higher above than below. Antennæ one-fourth longer than body, apical segments and apical portions of basal segments clothed internally with long hairs; scape with an incomplete cicatrix; third segment longer than scape and fourth; following rapidly decreasing in length. Prothorax broader than long, tuberculate anteriorly at sides; disc with five swellings, a pair of elongate ones in the middle and three in a transverse row near base. Scutellum small and narrow. Elytra broad, rounded behind; surface sparsely and heavily punctured. Sternal processes with opposing faces vertical. Length, 13 to 14 millimeters; breadth, 4.5 to 5.

Holotype, female (?), No. 51429, United States National Museum; Hassenzan, Formosa, altitude 1,300 meters, June 21, 1932; two paratopotypes in the author's collection, and a paratopotype in the California Academy of Sciences (Van Dyke collection), June 22 to 26, 1934.

This species differs from *S. alternans* Schwarzer with its hairy antennæ, the scape and apical segments shorter, its tuberculate prothoracic disc, and its vertical sternal processes.

HIPPOPSINI

Genus PSEUDOCALAMOBIUS Kraatz, 1879

PSEUDOCALAMOBIUS LEPTISSIMUS Gressitt sp. nov. Plate 1, fig. 14.

Extremely narrow and elongate, antennæ very fine and long, head fully as deep as rest of body; brown, anterior femora and scape dull reddish brown, rest of antennæ dark brown; head and thorax blackish brown, reddish brown on posterior margin of pronotum, clypeus dark amber, labrum light reddish brown, mandibles and palpi dark reddish brown, elytra dull chocolate-brown, redder at sides, legs and abdomen very dark chocolate-brown; antennæ with basal five segments clothed below with fine erect hairs, rest of body very finely clothed with minute, pale grayish brown hairs, sparser on elytra and denser on midline of pronotum, scutellum, and basal portion of elytral suture.

Head squarish in front, excluding mouth parts, broadest at eyes, slightly broader across genæ than at antennal tubercles; vertex fairly deeply concave between antennal tubercles, which are prominent, and swollen internally; frons weakly convex, apical margin slightly concave; clypeus short, impunctate; labrum convex, punctulate; palpi with apical segments of each pair swollen basally and acutely attenuate apically. Antennæ two and one-half times as long as body, exceedingly fine; scape cylindrical, reaching well beyond middle of prothorax; second segment barely longer than broad; third segment longer than first and shorter than fourth; fourth to tenth subequal; eleventh nearly double third. Prothorax roughly cylindrical, one-third longer than broad, widest before and behind middle. Scutellum longer than broad, rounded behind. Elytra long and narrow, slightly narrowed posteriorly; apices narrowed externally and produced into a blunt point at suture. Abdomen with first segment nearly twice as long as fourth, others subequal. Legs with femora swollen, hind pair no longer than first abdominal segment. Body largely finely punctured, elytra subseriately, abdomen most finely, and antennæ and lateral portions of meta-

sternum most heavily. Length, 10.5 to 12 millimeters; breadth, 1.5 to 2.

Holotype, female, No. 51428, United States National Museum; Arisan, central Formosa, altitude 2,300 meters, May 23, 1934, three paratopotypes, females, May 23 to 25, and a paratype, male, Taiheizan, northeastern Formosa, altitude 1,800 meters, May 8, 1932, in the author's collection; all collected by the author.

This species differs from *P. filiformis* Fairm. in being smaller and less parallel, in having the antennæ finer and less hairy below, and the elytra acute apically and lacking longitudinal stripes.

Genus METOPOPLECTUS Gressitt novum

Frons trapeziform; head directed posteriorly below; antennæ very long, scape swollen apically; prothorax nontuberculate; anterior coxal cavities closed behind; middle coxal cavities open exteriorly; tarsal claws moderately divergent; form only moderately elongate, narrow in fore body; shoulders prominent; elytra slightly narrowed posteriorly.

Head as broad as prothorax, subacute at apex, nearly twice as broad at genæ as at antennal tubercles, which latter are prominent and close; frons higher than wide, subparallel; eyes small, almost entire, hardly extending behind antennal supports, not very finely faceted; genæ large; clypeus short; labrum with apical margin slightly concave; palpi with last segment of each pair narrowed and subacute apically. Antennæ two and two-thirds to three and one-half times as long as body; scape reaching nearly to posterior margin of prothorax, gradually swollen posteriorly, second segment about as long as broad; third to tenth subequal and nearly as long as first; last longer than two preceding combined. Prothorax cylindrical, one-fourth longer than broad; base hardly broader than apex, two-thirds as broad as elytra. Scutellum as long as broad, rounded behind. Elytra very slightly narrowed in basal three-fourths; apices fairly abruptly narrowed, and narrowly rounded, or subtruncate, at suture. Abdomen with first segment not quite as long as following two united. Legs short; femora moderately swollen; hind pair reaching to middle of abdomen; middle tibiæ obliquely grooved exteriorly; tarsi nearly as long as tibiæ, the hind pair with the first segment barely as long as the following two united, last longest.

Genotype.—*Metopoplectus taiwanensis* Gressitt sp. nov.

Range.—Formosa and eastern China.

This genus is established for the following new species, as well as for *Cleptometopus orientalis* Mitono and an undescribed species from China.

Differs from *Cleptometopus* Thomson in being broader, in having the head shorter and less acute, the frons broader, the scape more swollen apically, the succeeding antennal segments lacking long apical hairs, the prothorax being less elongate and less narrowed apically, the elytra less attenuated, less heavily punctured basally, and not spined posteriorly, their surface with concave areas; and from *Pothyne* in having the superior lobes of eyes lacking, the antennæ much less hairy, the scape swollen, the prothorax narrower, and the elytra shorter. The form is less linear than in most Hippopsini, the elytra being considerably broader than the head and prothorax.

METOPOPLECTUS TAIWANENSIS Gressitt sp. nov. Plate 1, fig. 15.

Largely dull chocolate-brown, elytra partly very light brown, body clothed below with short grayish brown hairs and above with dark chocolate, and light tawny brown, hairs; front of head slightly reddish brown with a few pale hairs, thicker at sides; occiput blackish brown with a narrow midlongitudinal stripe of tawny hairs, and similar clothing behind eyes; antennæ with scape reddish brown on basal two-thirds, the apex blackish, remaining segments light brown basally, and dark chocolate-brown apically; prothorax with a median, and two lateral, broad, longitudinal tawny stripes; scutellum tawny; elytra dark brown basally, a few oblique pale stripes extending from basal portion of disc, humerus, and lateral margin, converging and meeting suture before middle, then an oblique dark brown area, irregular posteriorly and broader at suture, along which it extends posteriorly, joining inner one of two longitudinal subapical dark stripes, inner one not adjacent to suture, extreme apex dark, intervening postmedian and subapical areas pale brown.

Head fairly densely and finely punctured, not quite as broad near apices of genæ as at eyes, much narrower across antennal tubercles; eyes small, entire, very slightly longer than broad, rounded below and bluntly angulate above. Antennæ three to three and one-half times as long as body; scape swollen apically, very slightly longer than third segment; third to tenth subequal, last very long; five basal segments sparsely clothed below with short fine hairs. Prothorax barely longer than broad, very slightly swollen in middle; basal two-thirds as broad as elytra; surface fairly densely, and finely, punctured. Elytra very slightly narrowed in basal three-fourths; apices narrowly rounded at

suture; surface fairly densely, and moderately heavily, punctured in twelve or more rows, less heavily so posteriorly. Ventral surface moderately punctured, more heavily on sides of metasternum and more finely on abdomen. Length, 9.5 to 10.3 millimeters; breadth, 2.2 to 2.5.

Holotype, female, No. 51430, United States National Museum; Sakahen, northeastern Formosa, altitude 1,100 meters, July 16, 1934; allotype, male, Hori, central Formosa, at about 600 meters, June 9, 1934, in the author's collection; both taken by the author.

Differs from *M. orientalis* (Mitono) in its smaller size, its more swollen, and more arched, antennal scape, its less cylindrical prothorax, its rounded, instead of subacute, elytral apices, and its strongly punctured metasternum. The elytra are also less densely punctured than in the latter.

Genus ARISANIA Gressitt novum

Elongate, parallel-sided, cylindrical; frons narrow, broadest at antennal tubercles, which are very prominent; antennæ twice as long as body; pronotum with a small tubercle at each side; anterior coxæ subglobular, separate, closed behind; middle coxal cavities open exteriorly; middle tibiæ grooved externally; legs short, hind femora nearly as long as first two abdominal segments, tarsal claws divaricate; elytra long, rounded-truncate apically.

Head as broad as prothorax, higher than wide, directed slightly posteriorly below; eyes moderately narrow and long, very narrowly constricted behind antennal supports, ventral lobe large, fairly closely approaching mandibles, dorsal lobe minute; antennal tubercles large and very prominent, contiguous basally, diverging at an angle of 100°; frons higher than wide, broadest at antennal supports, subparallel below, swollen; clypeus short; labrum longer than clypeus, more than half as long as broad, punctulate; mandibles short, very thick basally; genæ minute; palpi with the apical segment of each pair subfusiform, thickened basally and truncate apically. Antennæ two and one-half times as long as body in male, twice as long in female; scape reaching to about middle of prothorax, subcylindrical, narrow at base, thickest before apex, external apical margin slightly emarginate; second segment broader than long; third to seventh segments subequal, cylindrical, progressively slightly longer and finer; last four segments shorter and finer; last longer than tenth, shorter than third. Prothorax as long as broad, broader at apex than at base; slightly constricted before the base, furnished with a

short, conical tubercle at each side, slightly behind middle; a slight swelling behind middle of disc; middle of posterior margin raised. Scutellum nearly as long as broad, rounded truncate behind. Elytra long, parallel, slightly constricted before middle, very slightly narrowed and subobliquely truncated at apices; surface subseriate-punctate. Anterior coxæ prominent, subglobose, their cavities angulate externally, separate, closed behind; middle coxæ less prominent, their cavities open externally to epimera; metasternum swollen at sides and abruptly declivitous apically; metepisternum narrowed posteriorly. Abdomen with last segment as long as first; second, third, and fourth successively shorter; last segment slightly emarginate below at apex in male, concave in apical half in female. Legs short, femora moderately swollen; tarsi as long as tibiæ, first segment of hind pair not as long as following two segments combined, claws divaricate.

Genotype.—*Arisania submarmorata* Gressitt sp. nov.

Range.—Formosa (central).

This genus is doubtfully placed in the Hippopsini, differing from the characteristic genera in having the frons narrowed apically, the antennæ not ciliate below, except for scape, the prothorax with a small tubercle at each side, and the tarsal claws divaricate. Differs in form from *Pseudocalamobius* in being broader and more cylindrical, with the antennæ thicker, and shorter in the male.

ARISANIA SUBMARMORATA Gressitt sp. nov. Plate 1, fig. 16.

Elongate, parallel; elytra two and one-half times as long as head and prothorax united; frons narrowed apically; antennal tubercles prominent; prothorax slightly tuberculate laterally; hind femora hardly reaching to end of second abdominal segment.

Reddish brown, blackish on front of head, middle of prothorax and ventral surface of body; body largely covered with short, recumbent brown hairs, forming mottled patterns: antennæ poorly clothed, scape only with very short, fine, erect hairs below; head, prothorax, and scutellum with light rusty brown hairs, an irregular naked patch in middle of disc of latter; elytra with a small, irregular, subbasal, discal spot and the apical third largely light rusty brown, a short, transverse, hairless band preceding the latter area, anterior three-fifths thinly and irregularly clothed with small spots of grayish brown hair; ventral surface grayish brown, sides of metathorax, apical segments, and sides

of basal segments, of abdomen irregularly rusty. Length, 7.5 to 10.5 millimeters; breadth, 1.5 to 2.5.

Holotype, male, No. 51431, United States National Museum; Arisan, Formosa, altitude 2,250 meters, June 4, 1932, allotopotype female, and 3 male paratopotypes in the author's collection, all taken the same day by the author.

The middle portion of each antennal segment is pale in the female.

Genus OBEREA Mulsant, 1839

OBEREA BREVITHORAX Gressitt sp. nov. Plate 1, fig. 17.

Elongate, prothorax short, elytra long, narrowed after basal third and slightly expanded preapically; head and antennæ pitch black, except for amber-colored clypeus and pale orange palpi; prothorax pale orange below, duller orange above with a very small black spot at each side near base; scutellum brownish black; elytra grayish black along suture and shiny black on shoulders, sides, and apices, yellow on middle of basal margin and with a walnut brown stripe along middle of disc to near apex, dotted with black punctures, subhumeral areas orange; ventral surface orange, except for black metepisternum, posterior three-fourths of metasternum, lateral margin of first, sides of second and third, and all but base of fifth, abdominal segments, hind tibiæ, external margins of anterior and middle tibiæ and tarsi above, except for base of third segment and large part of last, which is brown. Forebody and underside clothed with short, reclining hairs and longer and sparser erect pale or golden hairs, those on last abdominal segment and the erect ones on head black, elytra with pale reclining hairs on inner black portion and some erect ones on basal portion, the brown stripe nearly naked, shiny.

Head strongly swollen in front, very slightly concave on vertex, fairly heavily punctured except on posterior portion of occiput; eyes large, deeply constricted, ventral lobe broader than long, closely approaching mandibles. Antennæ (female) reaching to last fifth of elytra, all segments except second subequal in length. Prothorax very short, two-thirds as long as broad, hardly as broad as elytra at base, swollen above and with a raised area at each side; surface irregularly punctured, more sparsely on center of disc. Scutellum short, its posterior margin transverse. Elytra fully four times as long as head and prothorax united, narrowed and subparallel after first quarter, slightly expanded in last fifth; apices obliquely emarginate internally, with a small tooth at suture and a larger one at exter-

nal angle; surface with six longitudinal rows of large punctures. Mesepisternum moderately punctured, narrowed and raised above; metepisternum heavily punctured; metasternum punctured moderately at sides, more finely anteriorly; abdominal segments slightly punctured at sides. Legs short, hind femora reaching but slightly beyond end of first abdominal segment. Length, 19 millimeters; breadth, 2.5.

Holotype, female, California Academy of Sciences; Hori, Formosa, altitude 500 meters, June 9, 1934; collected by the author.

This species differs from *O. binotaticollis* Pic in having the prothorax short, the elytra much more attenuate, more oblique at the apices, more heavily punctured, relatively naked and partly brown, and the last abdominal segment shiny black except at base; it differs from *O. holoxantha formosana* Pic in having the head broader, the prothorax much shorter, and the elytra more attenuate, besides being largely black and brown.

JAPANESE NAMES

1. *Aromia faldermanni insularis* subsp. nov. Kikubi-usubane-kamikiri.
2. *Chloridolum loochooanum taiwanum* subsp. nov. Taiwan-midori-kamikiri.
3. *Kurarua constrictipennis* gen. et sp. nov. Kuraru-hosobane-kamikiri.
4. *Merionœda uraiensis* Kano. Urai-momobuto-hana-kamikiri.
5. *Merionœda formosana* Heller. Momobuto-hana-kamikiri.
6. *Xylotrechus rufonotatus* sp. nov. Akamon-tora-kamikiri.
7. *Perissus griseus* sp. nov. Usuao-tora-kamikiri.
8. *Raphuma notabiloides* sp. nov. Sakahen-tora-kamikiri.
9. *Demonax matsushitai* sp. nov. Matsushita-tora-kamikiri.
10. *Chlorophorus demonacoides* sp. nov. Suisha-tora-kamikiri.
11. *Chlorophorus miwai* sp. nov. Miwa-tora-kamikiri.
12. *Bunothorax* gen. nov. *takasagoensis* (Kano). Takasago-beni-kamikiri.
13. (*?*) *Saimia hirticornis* sp. nov. Kehige-gomafu-kamikiri.
14. *Pseudocalamobius leptissimus* sp. nov. Kōzan-dōboso-kamikiri.
15. *Metopoplectus taiwanensis* gen. et sp. nov. Hime-ebicha-higenaga-kamikiri.
16. *Arisania submarmorata* gen. et sp. nov. Arisan-higenaga-kamikiri.
17. *Oberea brevithorax* sp. nov. Tankubi-ringo-kamikiri.

ERRATUM

In the preceding paper of this series, Philip. Journ. Sci. 58 (1935) 253–266, on pages 259, 260, and 266, the genus should read *Anoploderomorpha*, instead of *Anoplodermorpha*.

ILLUSTRATION

Plate 1

[Magnified 1⅓ times.]

Fig. 1. *Aromia faldermanni* subsp. *insularis* Gressitt nov., holotype.
2. *Chloridolum loochooanum* subsp. *taiwanum* Gressitt nov., holotype.
3. *Bunothorax* (gen. nov.) *takasagoensis* (Kano), Taiheizan, Formosa.
4. *Raphuma notabiloides* Gressitt sp. nov., holotype.
5. *Kurarua constrictipennis* Gressitt gen. et sp. nov., holotype.
6. *Merionœda uraiensis* Kano, Bukai, Formosa.
7. *Merionœda formosana* Heller, Hassenzan, Formosa.
8. *Perissus griseus* Gressitt sp. nov., holotype.
9. *Xylotrechus rufonotatus* Gressitt sp. nov., holotype.
10. *Demonax matsushitai* Gressitt sp. nov., holotype.
11. *Chlorophorus demonacoides* Gressitt sp. nov., holotype.
12. *Chlorophorus miwai* Gressitt sp. nov., paratype, Hori, Formosa.
13. (?) *Saimia hirticornis* Gressitt sp. nov., holotype.
14. *Pseudocalamobius leptissimus* Gressitt sp. nov., holotype.
15. *Metopoplectus taiwanensis* Gressitt gen. et sp. nov., holotype.
16. *Arisania submarmorata* Gressitt gen. et sp. nov., holotype.
17. *Oberea brevithorax* Gressitt sp. nov., holotype.

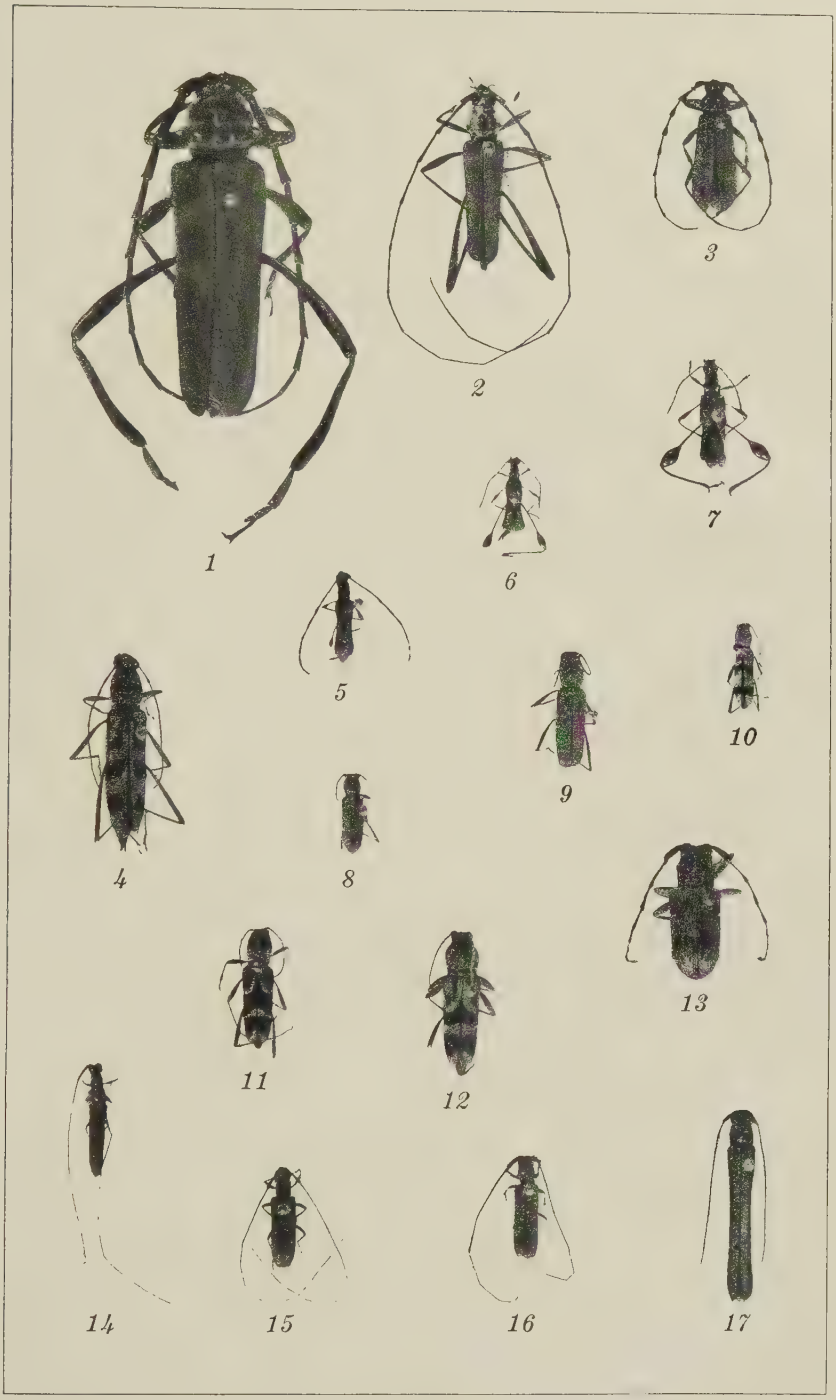

PLATE 1.

NEW OR LITTLE-KNOWN TIPULIDÆ FROM EASTERN ASIA (DIPTERA), XXXII[1]

By CHARLES P. ALEXANDER

Of Amherst, Massachusetts

TWO PLATES

Virtually all of the species of crane flies herein discussed are from Hainan Island where they were collected in 1935 by Mr. J. Linsley Gressitt. A few additional species are from the Khasi Hills, Assam, secured by Mr. S. Sircar and associated entomologists. All the types of novelties described at this time are preserved in my very extensive collection of these flies. I wish to express my very deepest thanks to the above-mentioned entomologists for their friendly coöperation in continuing this study of the Tipulidæ of southeastern Asia.

The rather extensive collections made in Hainan proved to be of exceptional interest, since virtually nothing had been made known of this rich faunal area. I am indebted to Mr. Gressitt for the following notes concerning various collecting stations at which Tipulidæ were secured:

TA HIAN. Altitude 2,000 feet, by stream, near northwestern foot of the Five Finger Mountains, south of the middle of the island; 10 miles south of Fan Heang.

TA HAN. Altitude 2,500 feet; small valley between passes of the Loi Mother Ranges and the Red Mist (Hung Mo) Range; on way from Nodoa to the Five Finger Mountains, about 20 miles north of Ta Hian.

TA HAU. Altitude about 900 feet; a small village near Vo Lau, in Dam-Chui, west and slightly south of Nodoa about 30 miles; flat country.

NODOA (NOTAI). Altitude about 1,000 feet; flat country, in the northwest-central part of the island.

FAN TA. Altitude about 1,250 feet; 22 miles south of Nodoa; beginning of low mountains.

CHUNG KON. Altitude about 1,050 feet; between Nodoa and Loi Mother Mountain, near Deng-ag River.

[1] Contribution from the entomological laboratory, Massachusetts State College.

DWA BI (TAI PIN). Altitude about 1,500 feet, at foot of north end of Loi Mother Range; about 20 miles west and slightly north of Liamui, near the center of the island.

LIAMUI. Altitude about 1,200 feet, near the eastern edge of mountains on a low plateau, with mountains on its east, between it and the great northern plain. From the hills around can be seen the Loi Mother Mountain, Red Mist Mountain, and the Five Fingers, to the west and southwest.

Besides the score of species of Tipulidæ described as new in the present report, Mr. Gressitt secured a number of additional crane flies that are recorded herewith to complete the data.

LIMONIA (RHIPIDIA) PULCHRA (de Meijere).

Ta Hian, June 13, 1935.

LIMONIA (GERANOMYIA) ARGENTIFERA (de Meijere).

Ta Hian, June 14, 1935; Ta Han, June 7, 1935; Liamui, July 31, 1935.

LIMONIA (THRYPTICOMYIA) APICALIS (Wiedemann).

Ta Hian, June 11, 1935; Ta Han, June 22 and 23, 1935.

CONOSIA IRRORATA (Wiedemann).

Ta Hian, June 15 to 18, 1935; Ta Han, June 22 to 24, 1935; Ta Hau, July 3, 1935; Nodoa, June 30, 1935; Chung Kon, July 17, 1935.

TRENTEPOHLIA (MONGOMA) PENNIPES (Osten Sacken).

Chung Kon, July 18, 1935.

TRENTEPOHLIA (TRENTEPOHLIA) PICTIPENNIS Bezzi.

Ta Hian, June 11, 1935; Ta Han, June 21, 1935.

TRENTEPOHLIA (TRENTEPOHLIA) TRENTEPOHLII (Wiedemann).

Ta Hian, June 11, 1935; Nodoa, June 20, 1935; Liamui, July 2, 1935; Ta Hau, July 4, 1935; Chung Kon, July 18, 1935; Dwa Bi, July 21, 1935.

GONOMYIA (LIPOPHLEPS) BICOLORATA Alexander.

Ta Han, June 23, 1935. Known hitherto only from Luzon.

GONOMYIA (LIPOPHLEPS) INCOMPLETA Brunetti.

Ta Hian, June 14, 1935; Ta Hau, July 3, 1935; Chung Kon, July 18, 1935; Dwa Bi, July 20, 1935.

TIPULINÆ

LONGURIO HAINANENSIS sp. nov. Plate 1, fig. 1.

General coloration of mesonotum and abdomen yellow and orange; head variegated with brownish black on lateral por-

tions of posterior vertex; wings narrow, tinged with gray; Rs short and arcuated, much shorter than R_{2+3}; m-cu a short distance before fork of M_{3+4}.

Female.—Length, about 20 millimeters; wing, 15.

Frontal prolongation of head yellowish white; nasus conspicuous, black; palpi black. Antennæ dark brown throughout, very small, if bent backward scarcely extending beyond the posterior border of head; flagellar segments cylindrical, with long, conspicuous verticils. Head whitish on front and anterior vertex, the central portion of posterior vertex and occiput yellow, the lateral portions of latter, together with the posterior orbits, brownish black.

Pronotum and propleura black. Mesonotum almost uniformly yellow, restrictedly variegated by darker, including the lateral ends of suture, margins of parascutella, and posterior border of mediotergite. Pleura obscure yellow, the posterior border of dorsopleural membrane with a conspicuous velvety black area; posterior portion of pleurotergal tubercle a little darkened. Halteres dirty white, the knobs darkened. Legs with the coxæ yellowish testaceous; trochanters whitened; remainder of legs brownish black. Wings (Plate 1, fig. 1) narrow, subhyaline or with a faint grayish tinge; stigma and cell Sc a little darker; veins brown. Macrotrichia on outer portions of veins R_3 and R_{4+5}; trichia on outer medial branches lacking or reduced to one or two scattered setæ. Venation: Rs short and arcuated, much shorter than R_{2+3}; distal end of Sc_1 atrophied; m-cu a short distance before fork of M_{3+4}; cell 2d A relatively wide.

Abdominal tergites orange-yellow, the incisures restrictedly paler; intermediate tergites with vague medial darkenings, on outer segments more evident and suffusing the caudal borders of the segments; sternites more yellowish, with a more or less distinct brown median stripe; pleural membrane infuscated. Ovipositor with small and inconspicuous, blunt valves.

Habitat.—China (Hainan Island).

Holotype, female, Dwa Bi, altitude about 1,500 feet, July 20, 1935 (*Gressitt*).

Longurio hainanensis is readily told from the four species hitherto described from China and Japan by the narrow, subhyaline wings, with Rs unusually short and arcuated. The most similar of the above-mentioned forms is *L. fulvus* Edwards (China, Formosa). I am not fully convinced that *Sphærionotus* de Meijere can be maintained as a genus distinct from *Longurio* Loew.

NEPHROTOMA HAINANICA sp. nov. Plate 1, fig. 2.

General coloration yellow, patterned with black; frontal prolongation of head darkened on sides; head orange, with no occipital brand; mesonotal præscutum with three polished black stripes that are narrowly bordered by velvety black, the central portion of median stripe paler on anterior half; scutellum, postnotum, and pleura yellow; wings with a faint dusky tinge, the stigma and cells Sc and Cu_1 darker; Sc_2 ending a short distance beyond origin of Rs, the latter subequal in length to R_{2+3}; cell M_1 broadly sessile; abdominal tergites weakly infuscated medially, the disk of the seventh tergite intensely blackened.

Female.—Length, about 14 millimeters; wing, 11.

Frontal prolongation of head light yellow above, dark brown on sides; nasus black, conspicuous. Antennæ with the scape brown; pedicel dark brown; flagellum black. Head orange; vertical tubercle very weakly notched; no differentiated occipital brand.

Pronotum and pleura orange-yellow. Mesonotal præscutum yellow with three polished black stripes, all narrowly bordered by velvety black; anterior end of median stripe with its central portion yellow, this pale color continued caudad for nearly one-half the length of the stripe; lateral stripes straight; scutum yellow, each lobe with two confluent polished black areas that are very narrowly bordered by velvety black; lateral ends of transverse suture infumed; scutellum and mediotergite yellow, without darkening, the latter with delicate setulæ on posterior lateral portions. Pleura yellow, variegated by more reddish yellow areas on the propleura, anepisternum, ventral sternopleurite, and meron. Halteres dusky, the base of stem restrictedly pale. Legs with the coxæ and trochanters yellow, the fore coxæ more reddish yellow; femora brownish yellow, somewhat clearer yellow at base, a little more darkened outwardly; tibiæ and tarsi brownish black to black. Wings (Plate 1, fig. 2) with a faint dusky tinge; stigma cell Sc, and the narrow cell Cu_1 infuscated; wing tip very gradually and insensibly darker than the remaining ground color of the membrane; veins dark brown. Stigmal trichia few. Venation: Sc_1 entirely preserved, Sc_2 ending a short distance beyond the origin of Rs, the latter subequal in length to R_{2+3} cell M_1 broadly sessile; m-cu at point of departure of vein M_4.

Abdominal tergites weakly infuscated medially, somewhat paler sublaterally at bases of segments; disk of seventh tergite intensely blackened, the borders yellow, the lateral margins more broadly

so; sternites more uniformly yellow. Ovipositor with genital shield obscure yellow; cerci nearly straight.

Habitat.—China (Hainan Island).

Holotype, female, Ta Han, altitude 2,500 feet, June 22, 1935 (*Gressitt*).

The thoracic pattern, especially the highly polished præscutal stripes that are narrowly margined with velvety black, is much as in *Nephrotoma siamensis* Edwards, which differs conspicuously in the occipital brand, black central præscutal vitta, dull black scutellum and apical third of mediotergite, and numerous other features. The coloration of the median præscutal stripe is approached by the otherwise very different Formosan species, *N. parva* Edwards.

CYLINDROTOMINÆ

PHALACROCERA TARSALBA sp. nov. Plate 1, fig. 3.

Front and anterior vertex silvery white, posterior vertex black; prothorax light yellow; mesonotum almost uniformly black; pleura yellow; legs darkened, the tarsi chiefly snowy white; wings narrow, the prearcular region petiolate; m-cu at fork of M; cell 2d A reduced to a narrow strip; abdominal tergites black, the sternites more greenish brown; ovipositor and genital segment brownish yellow.

Female.—Length, about 8 millimeters; wing, 8.

Rostrum yellow, palpi dark brown. Antennæ relatively short; scape and pedicel yellow, flagellum brownish black; flagellar segments passing into cylindrical, with verticils that much exceed the segments; terminal segment about one-half longer than the penultimate. Front and anterior vertex broad, silvery white; posterior vertex black, the occiput paling to dull yellow.

Prothorax entirely light yellow. Mesonotum almost uniformly black, greatly restricting the obscure yellow ground colors; præscutum with three confluent stripes, the yellow ground reduced to narrow humeral triangles; median regions of scutum and scutellum restrictedly pale; mediotergite narrowly margined with yellow, the disk black. Pleura and pleurotergite, together with the pleural membranes, uniformly pale yellow. Halteres dusky, the knobs infuscated, the base of stem restrictedly yellow. Legs with the coxæ and trochanters yellow; femora greenish basally, the tips gradually passing into brown; tibiæ brown, the tips darker; tarsi snowy white, the proximal ends of basitarsi blackened. (All legs are detached and the degree of blackening differs in the various legs; in some, only

the extreme tip, the distal fifth or sixth, is whitened, while in one pair, which is presumably the posterior one, the white includes the distal three-fifths.) Wings (Plate 1, fig. 3) with a weak brown tinge; stigma small, long-oval, dark brown; veins dark brown, the prearcular veins more yellowish brown. Wings with a long basal petiole. Venation: Sc_1 atrophied; Sc_2 ending just beyond fork of Rs, the free tip evident as a faint trace at near midlength of the stigma, m-cu at fork of M; cell 2d A reduced to a narrow strip.

Abdominal tergites black; sternites more greenish brown; ovipositor and genital segment brownish yellow.

Habitat.—China (Hainan Island).

Holotype, female, Ta Han, altitude 2,500 feet, June 25, 1935 (*Gressitt*). Paratopotypes, 1 female, 1 (sex?), June 21 and 22, 1935.

Phalacrocera tarsalba is readily told from all other allies in eastern Asia by the unusually narrow, petiolate wings, very narrow cell 2d A, and the snowy white tarsi. It has no close relative so far made known, the most similar form being *P. minuticornis* Alexander (western China). The discovery of a Palæarctic element such as the genus *Phalacrocera* at relatively low altitudes in Hainan has provided a surprise in geographic distribution.

LIMONIINÆ

LIMONIINI

Genus LIMONIA Meigen

Limonia MEIGEN, Illiger's Magazin 2 (1803) 262.

Subgenus GRESSITTOMYIA novum

Characters as in typical *Limonia*, differing most evidently in details of wing venation.

Antennæ 15-segmented; flagellar segments oval, the longest verticils unilaterally distributed on outer face, about one-third longer than the segments; terminal segment slender, about two-thirds the length of the penultimate. Anterior vertex narrower than the diameter of the scape. Claws with a single short spine near base. Wings (Plate 1, fig. 4) with Sc moderately long, Sc_1 ending beyond two-thirds the length of Rs, Sc_2 close to its tip; $Sc_2 + R_1$ gradually bent strongly caudad, at its outer end reducing vein R_2 to a short hyaline element, the free tip of Sc_2 correspondingly lengthened but entirely pale; a supernumerary crossvein in cell R_3 at near midlength; vein R_3 beyond the cross-

vein strongly sinuous, slightly constricting cell R_3 at near mid-length; a long fusion of veins R_{4+5} and M_{1+2}, nearly equal in length to Rs, completely obliterating r-m; cell 1st M_2 narrowed to a point at outer end, m being very short to nearly obliterated; outer medial veins deflected strongly caudad; m-cu at or close to fork of M, cell M_4 at margin unusually wide; anal veins nearly straight, parallel at origin. Male hypopygium (Plate 2, fig. 25) with the dorsal dististyle, *dd*, well developed, slender. Ventral dististyle, *vd*, small, with a long, slender, rostral prolongation that bears two, long, slender spines on a small tubercle at base; face of style bearing a larger and more conspicuous tubercle that has three, very long, slender setæ, these exceeding in length the rostral prolongation of the style.

Type of subgenus.—Limonia (*Gressittomyia*) *xenoptera* sp. nov. (Oriental Region: Eastern China, Hainan Island.)

The crane fly discussed under the above name is one of the strangest in appearance that has ever come to my attention. At first sight the venation seems quite irreconcilable with that of members of the genus *Limonia,* the veins beyond the cord being unusually complicated by fusions of elements and the presence of a supernumerary crossvein in cell R_3. However, there is no doubt that the fly is a member of the great genus *Limonia* and that it is necessary to erect a new subgeneric group for its reception. I take great pleasure in dedicating this subgenus to Mr. J. Linsley Gressitt, who has added materially to our knowledge of the Tipulidæ of eastern Asia.

The most unusual character of the group and the one that separates it from all other subgenera of *Limonia* is the profound fusion of veins R_{4+5} and M_{1+2}, a character suggested by certain other species of the genus, as *Limonia* (*Laosa*) *gloriosa* (Edwards) where the contact of veins R_{4+5} and M_{1+2} is merely punctiform. Elsewhere in the Tipulidæ such a long fusion of veins R_{4+5} and M_{1+2} is rare, being most evident in the tipuline genus *Ptilogyna* Westwood and in the limoniine genus *Trentepohlia* Bigot. In other groups of the Limoniinæ, a fusion of this nature occurs sporadically in genera such as *Helius* St. Fargeau and *Teucholabis* Osten Sacken, but throughout the entire family Tipulidæ its occurrence must be held to be decidedly uncommon. The presence of a supernumerary crossvein in the outer radial field is a character likewise possessed by three other subgenera of *Limonia;* namely, *Laosa* Edwards, *Dapanoptera* Westwood, and *Neolimnobia* Alexander. The group most nearly allied to

Gressittomyia would seem to be *Laosa*. For additional details and comparisons the discussion of the subgenera of *Limonia* as given by the writer in an earlier paper [2] may be consulted.

LIMONIA (GRESSITTOMYIA) XENOPTERA sp. nov. Plate 1, fig. 4; Plate 2, fig. 25.

General coloration orange; antennæ with scape and pedicel black, the flagellum obscure yellow, its outer segments more darkened; head silvery gray, with a capillary dark line on posterior vertex; halteres yellow, the knobs darkened; legs yellow, the femoral tips rather broadly blackened; wings hyaline, the prearcular and costal fields more yellowish, the outer radial, cubital, and anal fields more buffy; veins beyond cord conspicuously seamed with brownish black; R_{4+5} extensively fused with M_{1+2}; m very short to virtually lacking; male hypopygium with the rostral spines slender, from a common tubercle at base of prolongation.

Male.—Length, about 7 millimeters; wing, 8.2.

Rostrum and palpi black. Antennæ with scape and pedicel black; flagellum obscure yellow, the outer segments passing into brownish yellow; antennal structure as described under subgenus. Head silvery gray, with narrow black median line on posterior vertex.

Entire thorax orange, immaculate. Halteres yellow, the knobs dark brown. Legs yellow, the femoral tips rather broadly black, the amount subequal on all legs; outer tarsal segments infumed. Wings (Plate 1, fig. 4) hyaline, the prearcular region and cells C, Sc, and R light yellow; outer portion of cell R, cell 1st M_2, and base of R_5, with outer ends of cells Cu, 1st A, and 2d A, together with basal portion of Cu more buffy; veins beyond cord narrowly but conspicuously seamed with brownish black; veins black in the outer fields, paler in the cells basad of cord. Venation as described under the subgenus; second section of vein R_{4+5} subequal in length to the second section of M_{1+2}; Vein Cu_2 lying unusually far distant from vein Cu_1.

Abdomen, including hypopygium, deep orange, the pleural membrane weakly infumed; ventral dististyle of hypopygium infuscated. Male hypopygium (Plate 2, fig. 25) with the caudal margin of tergite, 9*t*, transverse or very gently emarginate, the setæ at and near border. Basistyle, *b*, with ventromesal lobe large. Dorsal dististyle, *dd*, a slender blackened hook, the acute tip slightly decurved. Ventral dististyle, *vd*, with the body small, shorter than the dorsal dististyle, its rostral prolongation long

[2] Philip. Journ. Sci. 40 (1929) 239–248.

and slender. Mesal-apical lobe of gonapophyses very slender. Ædeagus broad at base, narrowed to the bilobed apex.

Habitat.—China (Hainan Island).

Holotype, male, Ta Han, altitude 2,500 feet, June 22, 1935 (*Gressitt*).

The species requires no comparison with any other known member of the genus.

LIMONIA (LIMONIA) CALCARIFERA sp. nov. Plate 1, fig. 5.

General coloration obscure yellow, the præscutum darkened medially; flagellar segments gradually lengthened to the outermost; eyes broadly contiguous, ommatidia relatively coarse; pleura obscure yellow, variegated by darkened areas; femora yellow, the tips black; wings cream-colored, the base and costal portion clearer yellow; a restricted dark pattern, including the small stigma and a cloud at origin of Rs; Sc relatively long; Rs angulated and short-spurred at origin; m-cu at fork of M; anal veins convergent basally; abdominal tergites light brown; apices of cerci simple.

Female.—Length, about 7 millimeters; wing, 6.8.

Rostrum brown, palpi a little darker. Antennæ dark brown throughout; basal flagellar segments short-oval, the outer ones passing through oval to subcylindrical, becoming progressively longer outwardly; terminal segment pointed on distal end, about a fifth longer than the penultimate; extreme apex of flagellar segments glabrous and forming a pedicel, but not suddenly narrowed into a neck; verticils of outer segments subequal to or a trifle longer than the segments. Eyes broadly contiguous on anterior vertex; ommatidia relatively large and coarse; posterior vertex brownish gray.

Pronotum brown. Mesonotal præscutum obscure yellow, more infuscated medially; lateral stripes little or scarsely evident; setæ of interspaces erect and unusually long; præscutum with a weak, median impressed line, best developed on posterior half; scutal lobes dark brown, median area broadly obscure yellow; scutellum obscure yellow on basal portion, the posterior margin broadly infuscated, weakly pruinose; mediotergite dark brown, paler on lateral portions. Pleura obscure yellow, the propleura, anepisternum, and dorsal sternopleurite slightly infuscated. Halteres pale basally, the outer end of stem and the knobs infumed. Legs with the coxæ and trochanters testaceous-yellow; femora yellow, the tips rather broadly and conspicuously blackened; tibiæ yellowish brown, the tips narrowly and gradually darkened; tarsi passing into brownish black. Wings (Plate 1,

fig. 5) with the ground color somewhat creamy, the prearcular region and cells C and Sc clearer yellow; stigma subcircular, brown; a very restricted, scarcely evident, dark pattern, appearing as small clouds at origin of Rs and fork of Sc, and as a very narrow and vague apical darkening; cord and outer end of cell 1st M_2 very slightly darkened, most evident as a deepening in the intensity of the veins; veins yellow, darker beyond cord and in the clouded areas. Venation: Sc relatively long, Sc_1 ending about opposite four-fifths the length of Rs, Sc_2 near its tip; Rs weakly angulated and spurred near origin; free tip of Sc_2 and R_2 in transverse alignment; cell 1st M_2 widened outwardly, m about one-half the basal section of M_3; m-cu at fork of M; anal veins convergent basally, 2d A very gently sinuous.

Abdominal tergites light brown, scarcely variegated with darker; sternites more yellowish. Ovipositor with valves reddish horn-color, the bases of the hypovalvæ blackened; cerci upcurved and acute at tips.

Habitat.—China (Hainan Island).

Holotype, female, Dwa Bi, altitude about 1,500 feet, July 22, 1935 (*Gressitt*).

The general appearance of the present fly indicates that it is a member of the *pendleburyi* group. It differs from the typical form of this group, *Limonia* (*Limonia*) *pendleburyi* Edwards, of the Federated Malay States, and allied species, in the coloration of the body, legs, and wings and in the details of venation. The angulated and spurred Rs is a peculiar feature in the present group of flies.

LIMONIA (LIBNOTES) QUINQUE-COSTATA sp. nov. Plate 1, fig. 6.

General coloration brownish yellow, the præscutum with four darker brown stripes; antennæ black throughout; thoracic pleura brownish yellow, variegated by blackened areas; knobs of halteres dark brown; femora brownish black, the tips narrowly and abruptly yellow; tibiæ and tarsi black; wings cream-yellow, with a restricted dark pattern, including five small areas along costal border; free tip of Sc_2 and R_2 in approximate transverse alignment; anal veins strongly convergent; cerci bidentate at tips.

Female.—Length, about 10 millimeters; wing, 9.

Rostrum obscure brownish yellow; palpi black. Antennæ black throughout; basal flagellar segments globular, passing through short-oval to elongate; terminal segment about one-half longer than the penultimate; longest verticils exceeding

the segments. Front and anterior vertex buffy, the posterior portion of head more fulvous; anterior vertex reduced to a narrow strip that is only a little wider than the diameter of a single ommatidium.

Pronotum dark brown above, brownish yellow on sides. Mesonotal præscutum brownish yellow, the humeral region clear yellow; four darker brown præscutal stripes, the intermediate pair entirely confluent on anterior third of sclerite; a narrow blackish area borders internally the yellowish humeral portion of sclerite; scutal lobes dark brown, the median region more grayish; scutellum pale; mediotergite light gray, a trifle paler medially, more darkened on sides. Pleura brownish yellow, variegated by blackened areas on ventral propleura, dorsopleural membrane, ventral anepisternum, and dorsal sternopleurite. Halteres relatively long, the stem yellow, the knob dark brown. Legs slender; fore coxæ dark brown, the middle and hind coxæ yellow; femora obscure yellow basally, gradually deepening to brownish black, the tips narrowly but conspicuously yellow, the amount subequal on all legs; tibiæ and tarsi black. Wings (Plate 1, fig. 6) with the ground color cream-yellow, with a restricted brown pattern that is confined to the vicinity of the veins, including a series of five costal areas, distributed as follows: Arculus; cell Sc at near one-third the distance to Rs; origin of Rs; fork of Sc; and the small circular stigmal area on vein R_{1+2}, only slightly invading R_2; additional dark seams to many of the veins, including the cord, outer end of cell 1st M_2, more than the basal half of vein R_{2+3}, and outer end of vein 2d A; veins yellow, darkened in the clouded areas. Venation: Sc_1 ending beyond level of m-cu, Sc_2 at its tip; Rs very gently arcuated about four times the basal section of R_{4+5}; free tip of Sc_2 lying shortly proximad of R_2; cell 1st M_2 of moderate length; m and basal section of M_3 subequal; m-cu at near one-third the length of cell 1st M_2; outer radial and medial veins nearly straight or only gently curved; anal veins strongly convergent.

Abdominal tergites chiefly dark brown, the caudal portions of the segments a little more reddish brown; sternites brighter. Cerci stout, bidentate at tips.

Habitat.—China (Hainan Island).

Holotype, female, Ta Haan, altitude 2,500 feet, June 21, 1935 (*Gressitt*).

By Edward's key to the species of *Libnotes*,[3] the present fly runs to couplet 33, differing markedly from all species in the wing pattern and leg coloration. It runs more or less directly to *Limonia* (*Libnotes*) *longinervis* (Brunetti), an entirely different species.

ANTOCHA (ANTOCHA) FLAVIDULA sp. nov. Plate 1, fig. 7; Plate 2, fig. 26.

Size small (wing, male, 3.5 millimeters); head light gray; antennæ short, flagellum black; thorax and abdomen light yellow; halteres pale yellow; femora yellow, the tips narrowly and gradually infuscated; wings cream-colored, with a restricted, pale brown clouded pattern; m-cu more than one-fourth its length before the fork of M; male hypopygium with the outer dististyle suddenly narrowed at apex into an acute black spine.

Male.—Length, about 3.5 millimeters; wing, 3.5.

Rostrum obscure yellow; palpi a trifle darker. Antennæ short; scape and pedicel yellowish brown, flagellum black; flagellar segments small, subglobular to short-oval, the outer ones becoming more elongate. Head light gray.

Entire thorax light yellow. Halteres pale yellow. Legs with the coxæ and trochanters yellow; femora yellow, the tips narrowly and gradually infuscated; tibiæ pale brown, the tips slightly darker; tarsi infuscated. Wings (Plate 1, fig. 7) cream-colored, with a vague but evident pale brown pattern, distributed as clouds at origin of Rs, stigma, along cord and outer end of cell 1st M_2, and at the outer ends of veins R_3 and 1st A; veins yellow, pale brown in the clouded areas. Veins behind R_1 entirely glabrous. Venation: Sc relatively long, Sc_1 ending some distance beyond the fork of Rs; R_2 in virtual transverse alignment with r-m; cell 1st M_2 about as long as vein M_3 beyond it; basal section of M_3 longer than m; m-cu more than one-fourth its length before the fork of M.

Abdomen, including hypopygium, yellow. Male hypopygium (Plate 2, fig. 26) with the tergite narrowly transverse, the caudal margin approximately straight across or with the median portion a little projecting. Outer dististyle, *od*, relatively long and slender, at apex suddenly narrowed into an acute darkened spine. Inner dististyle broader, the apex obtuse. Phallosome, *p*, subtended on either side by a flattened, very pale plate, the apex of which is obtusely rounded. Outer gonapophysis, *g*, a simple slender rod, gradually narrowed to an acute point.

Habitat.—China (Hainan Island).

[3] Journ. Fed. Malay St. Mus. 14 (1928) 74–80.

Holotype, male, Dwa Bi, altitude about 1,500 feet, July 21, 1935 (*Gressitt*).

The present species is most closely allied to *Antocha* (*Antocha*) *flavella* Edwards and *A.* (*A.*) *nebulosa* Edwards, both from the Malay Peninsula, differing in the gray coloration of the head, color of the antennæ, uniformly yellow thorax and abdomen, darkened femoral tips, and details of pattern of the wings. In the last-mentioned regard, the fly is more like *nebulosa*, which in all other respects is very distinct.

ANTOCHA (ANTOCHA) KHASIENSIS sp. nov. Plate 1, fig. 8; Plate 2, fig. 27.

General coloration pale yellow, the transverse suture of mesonotum narrowly darkened; antennæ yellow; legs yellow, the tips of femora rather narrowly but conspicuously blackened; wings milky white, patterned with brownish black, including the prearcular field and subcostal cell as far distad as the level of origin of Rs; cord and outer end of cell 1st M_2 narrowly seamed with dark; m-cu more than its own length before the fork of M; male hypopygium with the outer dististyle obtuse at apex; inner gonapophysis acutely pointed, with a pale lateral flange.

Male.—Length, about 3.5 to 3.7 millimeters; wing, 4 to 4.4.

Female.—Length, about 3.5 millimeters; wing, 4.

Rostrum yellow; palpi scarcely darkened. Antennæ short, yellow, the outer flagellar segments a trifle darker; flagellar segments oval. Head yellow.

Mesonotum pale yellow, the suture narrowly dark brown, the pattern a little more expanded at lateral ends. Pleura pale yellow. Halteres pale yellow throughout. Legs yellow, the tips of the femora narrowly but conspicuously blackened, the amount subequal on all legs; in the allotype the femora are somewhat less extensively darkened; tibiæ more narrowly darkened at tips; tarsi yellow, the outer segments darker. Wings (Plate 1, fig. 8) milky white, patterned with brownish black, in the costal field the latter color alternating with brighter yellow areas, most evident on the costal vein before and beyond the dark stigma; prearcular field and cell Sc as far distad as the origin of Rs blackened; cord and outer end of cell 1st M_2 seamed with blackish; veins pale, darker in the clouded areas, including the outer medial veins. Venation: R_{2+3} only a little longer than R_2, the latter lying far before the level of r-m; m-cu more than its own length before the fork of M.

Abdomen, including hypopygium, yellow. Male hypopygium (Plate 2, fig. 27) with the outer dististyle, *od*, short, and unusual-

ly obtuse at apex. Inner gonapophysis, *g*, terminating in an acute spinous point, the outer margin back from the point expanded into a pale flange that is wider towards the base.

Habitat.—Assam (Khasi Hills).

Holotype, male, Cherrapunji, altitude 4,000 feet, August, 1935 (*Sircar*). Allotopotype, female. Paratopotypes, 2 males.

Antocha (*Antocha*) *khasiensis* is most nearly related to *A.* (*A.*) *nigribasis* Alexander (western China), differing most conspicuously in the small size and structure of the male hypopygium. It is readily told from all other previously described species of the Himalayan and Indo-Malayan regions by the extreme basal position of m-cu and the coloration of the body, legs, and wings.

I am greatly indebted to Mr. S. Sircar for the following data on the conditions under which the present series of Tipulidæ were collected. "The specimens were collected by me personally at light (400 C. P. Petromax). It was showering very mildly and from my experience I can say that this is the best time for collecting Tipulidæ at light. Hundreds of these flies came to the light, but I could not save all of them as my net got wet and I had to catch them by hand as they rested on a cloth hung up by the side of the light."—S. SIRCAR.

HEXATOMINI

PSEUDOLIMNOPHILA CONCUSSA sp. nov. Plate 1, fig. 9; Plate 2, fig. 28.

General coloration brownish gray; antennæ black; wings relatively narrow, almost uniformly tinged with brownish yellow; costal fringe short; Rs long, subequal to vein R_3; R_2 at or close to fork of R_{3+4}; cell M_1 present; cell 1st M_2 long and narrow, subequal to vein M_4 beyond it; m-cu at or close to fork of M.

Male.—Length, about 7 millimeters; wing, 6.8.

Female.—Length, about 8 millimeters; wing; 7.5.

Rostrum dark; palpi black. Antennæ brownish black to black throughout, or (male) with the basal half of first flagellar segment paler; flagellar segments subcylindrical to cylindrical, with long conspicuous verticils. Head brownish gray; anterior vertex and orbits clearer gray.

Pronotum dark brownish gray. Mesonotum brownish gray, the præscutum with a slightly darker median stripe, somewhat more intense on cephalic portion; pseudosutural foveæ black. Pleura gray, variegated by more blackish gray on ventral anepisternum, sternopleurite, and meron. Halteres pale, the knobs infuscated. Legs with the fore coxæ blackened, heavily pruinose; middle and hind coxæ much paler; trochanters testaceous-

yellow; remainder of legs brownish yellow or, in cases, the femora more yellowish brown. Wings (Plate 1, fig. 9) relatively narrow, as compared to *inconcussa,* almost uniformly tinged with brownish yellow; stigma very faintly darker; veins darker brown. Costal fringe short in both sexes; Venation: Sc_1 ending opposite or just before fork of Rs, Sc_2 at its tip; Rs long, nearly straight to very gently arcuated at origin; R_{2+3+4} elongate, only a little shorter than vein R_3; R_2 at or very close to fork of R_{3+4}; R_{1+2} from one and one-half to twice the length of R_2; cell M_1 present, about as long as its petiole; cell 1st M_2 relatively long and narrow, its inner end arcuated, the lower face of the cell subequal to or even longer than vein M_4; m-cu at or just beyond fork of M; anterior arculus present.

Abdomen dark brown, sparsely pruinose, the hypopygium a trifle brighter. Male hypopygium (Plate 2, fig. 28) with the outer dististyle, *od,* a little longer than the inner style, *id,* straight, its apex decurved into a slender spine; inner margin before apex with a few denticles. Interbasal rods slender, each with a low obtuse flange at near midlength.

Habitat.—China (Hainan Island).

Holotype, male, Ta Hian, altitude 2,000 feet, June 14, 1935 (*Gressitt*). Allotype, female, Dwa Bi, altitude about 1,500 feet, July 21, 1935 (*Gressitt*).

Pseudolimnophila concussa is very closely allied to *P. inconcussa* (Alexander), of Japan and China, and may prove to be only a more southern race of the latter. The unusually narrow wings, with narrow cell 1st M_2 serve to separate the fly from the usually larger and more vigorous *inconcussa.*

PSEUDOLIMNOPHILA SETICOSTATA sp. nov. Plate 1, fig. 10.

General coloration of mesonotum uniformly dark brown, the pleura a little paler; antennæ black throughout; flagellar verticils very long; legs brownish black; wings a faint brown tinge; costal fringe (male) unusually long and dense; R_2 at or before fork of R_{3+4}; cell M_1 lacking; m-cu a short distance beyond fork of M; abdominal tergites dark brown, the sternites more brownish yellow.

Male.—Length, about 5 millimeters; wing, 5.5.

Rostrum obscure yellow to yellowish brown; palpi black. Antennæ black throughout; flagellar segments subcylindrical, with long verticils that greatly exceed the segments. Head brownish black above, the anterior vertex and orbits a very little paler; anterior vertex relatively wide, exceeding twice the diameter of scape.

Pronotum and mesonotum almost uniformly dark brown, the pleura a little paler. Halteres dusky, the base of stem very narrowly paler. Legs with the coxæ brown; trochanters yellowish brown; remainder of legs brownish black. Wings (Plate 1, fig. 10) with a faint brownish tinge; stigma oval, slightly darker brown; veins medium brown, much darker than the ground. Costal fringe (male) unusually long and dense, the setæ longer than the width of cell Sc_1. Venation: Sc_1 ending shortly before level of fork of Rs, Sc_2 near its tip; R_2 variable in position, in the paratype being some distance before the fork of R_{3+4}, veins R_{1+2}, R_2, and R_{3+4} in this case being subequal in length; in the holotype R_2 is at or very close to the fork of R_{3+4}, eliminating or greatly reducing the latter element; veins R_3 and R_4 diverging rather conspicuously, cell R_3 at margin being considerably more extensive than cell R_2; cell M_1 lacking; m-cu a short distance beyond fork of M; anterior arculus present.

Abdominal tergites dark brown, the sternites and hypopygium more brownish yellow.

Habitat.—China (Hainan Island).

Holotype, male, Ta Han, altitude 2,500 feet, June 21, 1935 (*Gressitt*). Paratype, male, Dwa Bi, altitude about 1,500 feet, July 22, 1935 (*Gressitt*).

The long dense costal fringe of the male (though possibly not of the still unknown female) is much like that of the otherwise very distinct *P. costofimbriata* Alexander, of southern India, the latter species having cell M_1 present and very deep. *Pseudolimnophila descripta* Alexander, of the mountains of Formosa, has cell M_1 lacking, but differs from the present fly in other venational details. The female sex of the latter species has the costal fringe short, but the male is still unknown.

Genus HEXATOMA Latreille

Hexatoma LATREILLE, Gen. Crust. et Ins. 4 (1809) 260.

Subgenus EUHEXATOMA novum

Characters as in the subgenus *Eriocera* Macquart, having four branches of radius and four of media reaching the wing margin; cell 1st M_2 closed. Supernumerary crossveins in each of cells R_3, R_4, and R_5 in approximate alignment (Plate 1, fig. 11).

Type of subgenus.—*Hexatoma* (*Euhexatoma*) *triphragma* sp. nov. (Oriental Region: Eastern China, Hainan Island).

The new subgenus is based on the presence of three strong supernumerary crossveins in the outer radial field of the wing, a character paralleled by other subgeneric groups in the allied

hexatomine genera *Adelphomyia* Bergroth and *Limnophila* Macquart. The present fly is of very strange appearance, the outer radial field giving one a definite impression of resemblance to the wing of a scorpion fly (Mecoptera).

HEXATOMA (EUHEXATOMA) TRIPHRAGMA sp. nov. Plate 1, fig. 11.

General coloration of thorax brownish yellow, the præscutum with three confluent darker brown stripes; antennal flagellum yellow; femora yellow, the tips narrowly blackened; wings dark brown, the veins narrowly but conspicuously bordered by yellow; wing tip more broadly yellowish; small paired hyaline droplets near outer ends of cells R_4 and R_5, respectively; supernumerary crossveins in cells R_3, R_4, and R_5; cell M_1 present; m-cu at near two-thirds the length of cell 1st M_2; abdominal tergites reddish brown, the hypopygium brownish yellow.

Male.—Length, about 20 millimeters; wing, 16.

Rostrum dark brown; palpi short, brown. Antennæ 7-segmented; scape and pedicel yellowish brown; flagellum yellow, the outer segments a little darkened; flagellar segments cylindrical, gradually decreasing in length outwardly. Head brown; vertical tubercle entire, its margin rounded.

Pronotum brown. Mesonotal præscutum brownish yellow, with three darker brown stripes that are confluent behind; posterior sclerites of notum chiefly brownish black. Pleura obscure yellow, variegated by dark brown on the ventral anepisternum, ventral sternopleurite, meron, and pleurotergite. Halteres brownish yellow. Legs with the coxæ light brown, trochanters more reddish brown; femora yellow, the tips narrowly blackened, the amount subequal on all legs and including about the distal sixth or seventh of the segment; tibiæ brown, the tips narrowly blackened; tarsi black. Wings (Plate 1, fig. 11) with the ground color dark brown, the veins narrowly but conspicuously bordered by yellow; wing tip more extensively of the same color; two small paired hyaline droplets near outer ends of cells R_4 and R_5, beyond the supernumerary crossveins of these cells; cell 1st A more grayish, cell 2d A yellow, margined outwardly with gray; vague linear pale streaks in central portions of cells R_1, M, and M_4; veins yellow to brownish yellow, contrasting with the dark ground. Scattered macrotrichia on all outer radial branches. Venation: Sc_1 ending about opposite R_2; R_{2+3+4} a little shorter than the basal section of R_5; R_{1+2} longer than R_{2+3+4}; the supernumerary crossveins in the radial field slightly variable in position, those in cells R_3 and R_4 more oblique

than the one in cell R_5; in the left wing of type, the vein in cell R_3 lies more than its own length beyond the one in cell R_5, whereas in the right wing the elements are nearly interstitial, as illustrated; cell M_1 present; m-cu much longer than the distal section of Cu_1, placed at near two-thirds the length of cell 1st M_2.

Abdominal tergites deep reddish brown, without differentiated basal coloring on the individual segments; basal and subterminal segments somewhat darker; sternites clearer reddish brown; hypopygium brownish yellow.

Habitat.—China (Hainan Island).

Holotype, male, Liamui, altitude about 1,200 feet, July 31, 1935 (*Gressitt*).

This rather remarkable crane fly requires no comparison with any previously described member of the genus, the subgeneric character of three supernumerary crossveins in the outer radial field being quite unique within the group.

HEXATOMA (ERIOCERA) TUBERCULATA sp. nov. Plate 1, fig. 12.

Belongs to the *perennis* group; general coloration of thorax dull gray, the præscutum with four scarcely differentiated plumbeous-gray stripes that are narrowly bordered by blackish; setæ of thoracic dorsum short and inconspicuous; a median series of from three to five small tubercles at cephalic portion of præscutum; halteres and legs black; wings dark brown, with an oval yellow discal area before cord; costal vein in both sexes with abundant short setæ; cell M_1 present; abdominal tergites purplish blue, with about the outer third of the segments dull black; hypopygium and shield of ovipositor orange.

Male.—Length, about 19 to 24 millimeters, wing, 15 to 19.

Female.—Length, about 24 to 25 millimeters; wing, 16 to 17.

Rostrum dark gray; palpi black. Antennæ short in both sexes, in male 7-segmented, in female 11-segmented; scape and pedicel black, sparsely pruinose; flagellum obscure yellow to yellowish brown. Head dull black, a little more grayish on front and on posterior orbits; vertical tubercle entire, unusually slender, especially in male. Vestiture of head of moderate length.

Pronotum dull dark gray, the lateral angles of the scutum produced into tuberculate lobes; scutellum with a deep median incision on anterior border. Mesonotal præscutum dull gray, with four scarcely differentiated plumbeous-gray stripes that are narrowly bordered by blackish; anteromedian portion of præscutum elevated into from three to five small tubercles arranged in a longitudinal row; posterior sclerites of notum dull plumbeous-gray. Vestiture of thoracic dorsum unusually short and sparse.

Pleura entirely blackened, very sparsely pruinose. Halteres short, black throughout. Legs entirely black. Wings (Plate 1, fig. 12) dark brown, the anal cells a little paler; an oval yellow discal area before the cord, occupying the outer end of cell R and adjoining parts of cells R_1 and M, with a slight invasion of the extreme base of cell 1st M_2; veins dark reddish brown, brighter in the yellow area; some of the veins adjoining the discal brightening very narrowly and insensibly bordered by yellow. Costa with abundant small setæ in both sexes; outer branches of R with trichia, more sparse and scattered on R_5; a few scattered trichia on vein M_1 and, in cases, on M_2. Venation: Sc_1 ending shortly beyond R_2; Rs angulated to spurred very close to origin; R_{1+2} much longer than R_{2+3+4}, the latter subequal to basal section of R_5; cell M_1 present; m-cu at near two-thirds to three-fourths the length of cell 1st M_2.

Abdominal tergites two to seven, inclusive, brilliant purplish blue, the caudal margins of the segments dull black, involving about the outer third of the sclerite; sternites more uniformly blackened, the basal rings less brilliantly blue; male hypopygium and shield of ovipositor orange.

Habitat.—China (Hainan Island).

Holotype, male, Fan Ta, altitude about 1,250 feet, June 3, 1935 (*Gressitt*). Allotype, female, Ta Hian, altitude 2,000 feet, June 11, 1935 (*Gressitt*). Paratypes, 2 males, with the allotype, June 12 and 13, 1935; 1 male, 1 female, Liamui, altitude about 1,200 feet, August 1 and 2, 1935 (*Gressitt*).

By Edwards's key to the Old World species of *Eriocera,*[4] the present fly runs to couplet 87, disagreeing with species beyond this point by the lack of yellow or orange areas on the intermediate abdominal segments, as well as in several other features. The fly is quite distinct from all other species known to me.

HEXATOMA (ERIOCERA) HIRTITHORAX sp. nov. Plate 1, fig. 13.

General coloration deep velvety black; head and thorax with long, coarse, erect setæ; halteres and legs black; wings strongly blackened, with a narrow white discal area before the cord; numerous macrotrichia on veins beyond cord; cell M_1 lacking; m-cu beyond outer end of cell 1st M_2 on vein M_4; abdomen velvety black, segments two, four, and five with leaden-colored basal bands; genital shield black; valves of ovipositor orange.

Female.—Length, about 16 millimeters; wing, 12.5.

[4] Ann. & Mag. Nat. Hist. IX 8 (1921) 70–78.

Rostrum black, sparsely pruinose; palpi black. Antennæ (female) 11-segmented; scape and pedicel black; flagellum brownish black, the incisures of the more proximal segments narrowly paler; flagellar segments with long coarse verticils; segments gradually decreasing in length outwardly, the terminal a little longer than the penultimate. Head dark gray, with very long, coarse, black setæ.

Thorax uniformly velvety black, with long coarse setæ, especially conspicuous on the dorsum. Halteres and legs black throughout. Wings (Plate 1, fig. 13) strongly blackened, the anal cells much paler, grayish; a narrow white discal area before cord, including cells R_1 to Cu, inclusive, the last area narrowly separated from the remainder of the band by a narrow dark seam adjoining vein Cu in cell M; the gray anal cells variegated by more infuscated area at near midlength and by more brightened areas near outer end of cell 1st A and basal portion of cell 2d A; veins dark, paler in the discal brightening. Costal fringe short but abundant, longer and more conspicuous basad of h; macrotrichia of veins beyond cord abundant, including all veins from R_{1+2} to Cu_1, inclusive, more sparse and restricted in the medial and cubital fields. Venation: Sc_1 ending nearly opposite R_2; R_{1+2} much longer than either R_{2+3+4} or R_{2+3}; medial veins very faint and difficult to trace; cell M_1 lacking; m-cu erect, placed beyond the outer end of cell 1st M_2 on vein M_4.

Abdomen velvety black, segments two, four, and five with leaden-colored or plumbeous basal bands, segments three, six, and seven uniformly blackened; sternites black; genital shield black; valves of ovipositor orange.

Habitat.—China (Hainan Island).

Holotype, female, Liamui, altitude about 1,200 feet, July 31, 1935 (*Gressitt*).

Hexatoma (*Eriocera*) *hirtithorax* is one of rather numerous species discovered in recent years that runs to *H.* (*E.*) *hilpa* (Walker) by means of existing keys to the subgenus. It is distinguished from allies in this particular group of forms by the coloration of the wings and abdomen, the venation, as the deep fork of cell R_3 and direction and position of m-cu, and by the unusually long erect pubescence of the head and thorax. In the latter feature the species agrees well with *H.* (*E.*) *villosa* Edwards (Perak), which has an apical pale crescent on the wings, additional to the pale discal area.

ELEPHANTOMYIA (ELEPHANTOMYODES) ANGUSTICELLULA sp. nov. Plate 1, fig. 14.

General coloration of mesonotum brownish yellow, the pleura a trifle more infuscated; rostrum approximately one-half as long as remainder of body; basitarsus with proximal two-thirds black, the distal third snowy white; wings subhyaline; cell Sc, stigma and outer end of cell R_2 uniformly and continuously infuscated; basal section of R_5 almost in longitudinal alignment with Rs; cell 2d A very short and narrow; abdominal tergites inconspicuously bicolorous, obscure yellow, the caudal portions of the segments blackened, the outer three segments uniformly blackened.

Male.—Length, excluding rostrum, about 10 millimeters; wing, 6.5; rostrum alone, 5.

Rostrum black throughout, approximately one-half as long as remainder of body. Antennæ black; flagellar verticils long and conspicuous. Head brown, the orbits narrowly light gray; anterior vertex relatively wide, a little greater than the diameter of scape.

Mesonotum uniformly dull brownish yellow, the pleura a trifle more infuscated. Halteres obscure, the knobs a trifle more dusky. Legs with the coxæ weakly infuscated; trochanters brownish yellow; femora brownish black, a little brightened basally, deepening to black at tips; tibiæ black; basitarsi black, the distal third snowy white; remainder of tarsi snowy white, the terminal segment infumed. Wings (Plate 1, fig. 14) subhyaline, cell Sc, stigma and adjoining narrowed outer portion of cell R_2 uniformly and continuously infuscated; veins black. Venation: Rs strongly arcuated; anterior branch of Rs at origin arcuated in almost the same degree as Rs, its distal portion gently sinuous and running close to R_1; basal section of vein R_5 almost in longitudinal alignment with the end of Rs, a little shorter than r-m; cell 1st M_2 longer than vein M_4 beyond it; m-cu about one-half its length beyond the fork of M; cell Cu gradually widened to margin; vein 2d A short, the cell unusually short and narrow.

Abdominal tergites obscure yellow, blackened medially and caudally, the outer three segments uniformly blackened; sternites more uniformly obscure yellow, the caudal portions of the segments more infuscated.

Habitat.—China (Hainan Island).

Holotype, male, Ta Han, altitude 2,000 feet, June 7, 1935 (*Gressitt*).

Elephantomyia (*Elephantomyodes*) *angusticellula* is generally similar to several other species of the subgenus in the Oriental and eastern Palæarctic faunal regions, such as *E.* (*E.*) *aurantia* (Brunetti), *E.* (*E.*) *fuscomarginata* Enderlein, and *E.* (*E.*) *uniformis* Alexander, differing from all in the body coloration and the details of venation, especially the very short and narrow cell 2d A. In the last-mentioned regard, the nearest approach to the present fly is found in *uniformis*.

ERIOPTERINI

TRENTEPOHLIA (MONGOMA) HAINANICA sp. nov. Plate 1, fig. 15.

Thorax entirely orange-yellow, immaculate; antennæ black throughout; femora obscure yellow basally, passing into brown; tibiæ dark brown; tarsi paling to yellowish brown; wings whitish subhyaline, the prearcular and costal regions clear light yellow; a restricted dark pattern, including the wing tip and a seam along vein Cu_1; R_2 at or beyond the fork of R_{2+3+4}; abdomen black, the bases of the intermediate segments vaguely brightened.

Male.—Length, about 9 millimeters; wing, 7.2.

Female.—Length, about 11 millimeters; wing, 8.5.

Rostrum brown; palpi black. Antennæ black throughout; flagellar segments cylindrical, the verticils shorter than the segments. Head brownish yellow; anterior vertex reduced to a narrow strip, carinate, the ridge extending caudad onto the posterior vertex.

Pronotum yellow. Mesonotum and pleura entirely deep orange-yellow, immaculate. Halteres with basal third of stem obscure yellow, the outer portion and knob blackened. Legs with the coxæ and trochanters yellow; femora obscure yellow basally, passing into brown, the tips gradually deepening to dark brown; tibiæ dark brown; tarsi paling to yellowish brown; bases of femora with a series of from eight to ten small black spines; posterior tibiæ near apex with about four powerful black setæ, the outermost shorter. Wings (Plate 1, fig. 15) whitish subhyaline, the prearcular and costal regions clear light yellow; stigma dark brown; paler brown washes include the extensive wing tip, vague seams along cord, a broad, conspicuous seam in cell M adjoining vein Cu, and the axillary region; veins brownish black, luteous in the yellow basal and costal portions. Venation: R_2 at or beyond fork of R_{2+3+4}; m-cu at or before (male) fork of M; apical fusion of veins Cu_1 and 1st A slight; cell 2d A wide.

Abdomen black, the bases of the intermediate tergites very vaguely brightened by brownish yellow; genitalia of both sexes obscure yellow.

Habitat.—China (Hainan Island).

Holotype, male, Ta Han, altitude 2,500 feet, June 22, 1935 (*Gressitt*). Allotopotype, female, June 23, 1935 (*Gressitt*).

Trentepohlia (*Mongoma*) *hainanica* is allied to *T.* (*M.*) *auricosta* Alexander and *T.* (*M.*) *flavicollis* Edwards, of Java, especially to the former. The differently patterned thorax, legs, and wings, and the uniformly darkened halteres, readily separate the present fly from these somewhat similar species. By my latest key to the Philippine species of *Trentepohlia*,[5] the fly runs to *T.* (*M.*) *carbonipes* Alexander, of Mindanao, a very different fly.

GONOMYIA (PTILOSTENA) HAINANENSIS sp. nov. Plate 1, fig. 16.

General coloration of mesonotum dark brown, more reddish brown on sides; knobs of halteres darkened; femora yellow, with a narrow but conspicuous brownish black ring just before apex; wings yellow, sparsely patterned with dark brown; stigma oval, extending distad to vein R_3; vein R_1 gently arcuated; abdominal tergites black, the caudal margins narrowly yellow.

Female.—Length, about 5.5 millimeters; wing, 5.

Rostrum and palpi dark. Antennæ with scape brownish yellow; pedicel yellow; flagellum broken. Head brownish gray.

Pronotum obscure yellow above, darker on sides. Lateral pretergites light yellow. Mesonotal præscutum dark brown medially, more reddish brown on sides, the humeral region with a very restricted area of light yellow; pseudosutural foveæ brownish black; scutum dark brown; scutellum testaceous-brown; mediotergite dark, with a pruinose gray triangle on cephalic portion, the point directed backward. Pleura reddish brown, the dorsal sclerites somewhat darker. Halteres pale, the knobs darkened. Legs with the coxæ testaceous-brown; trochanters testaceous-yellow; femora yellow, with a narrow but conspicuous brownish black ring just before apex; tibiæ obscure yellow, the tips narrowly blackened; tarsi brownish yellow, darker outwardly. Wings (Plate 1, fig. 16) with the ground color yellow, sparsely patterned with dark brown, the areas including a small arcular darkening, origin of Rs, cord and m-cu, stigma, and a

[5] Philip. Journ. Sci. 53 (1934) 442–444.

paler brown submarginal wash in outer ends of cells R_3 and R_4; no darkening at outer end of vein 2d A; wing tip deeper yellow than the remainder of ground; stigmal area oval, extending distad to vein R_3 or virtually so; veins yellow, darker in the infuscated areas. Costal fringe relatively long and conspicuous; numerous macrotrichia on all veins beyond level of m-cu and on veins M and 1st A nearer the wing base. Venation: Sc_1 ending about opposite one-fourth the length of the strongly angulated to weakly spurred Rs; R_{1+2} and R_3 close together at wing margin; vein R_4 gently arcuated, not strongly recurved as in *teranishii* and allies; medial fork about one-third longer than its petiole; m-cu less than twice its length before fork of M.

Abdominal tergites black, the caudal margins of the segments narrowly but conspicuously yellow; sternites more brownish yellow, the yellow apices not so clearly defined.

Habitat.—China (Hainan Island).

Holotype, female, Ta Han, altitude 2,500 feet, June 21, 1935 (*Gressitt*).

The nearest described allies are *Gonomyia* (*Ptilostena*) *longipennis* Alexander (Loochoo Islands) and *G.* (*P.*) *teranishii* Alexander (Japan, eastern and southern China), which differ in the coloration of the body, the uniformly pale femora, and the details of wing pattern and venation, notably the more strongly arcuated vein R_4.

GONOMYIA (LIPOPHLEPS) CONQUISITA sp. nov. Plate 1, fig. 17.

Belongs to the *sulphurella* group; allied to *nubeculosa;* general coloration of notum dark gray; scutellum obscure yellow, darkened medially at base; femora yellow, with a narrow, dark brown, subterminal ring, the yellow apex subequal in extent or slightly wider; wings tinged with grayish, the costal border and apex whitened; abdominal tergites black, the caudal borders of the segments narrowly yellow.

Female.—Length, about 5 millimeters; wing, 4.

Rostrum and palpi black. Antennæ with scape and pedicel yellow above, darker on lower surface; flagellum broken. Head above obscure yellow, the central portion of posterior vertex more infuscated, its sides and the genæ again darkened.

Pronotum yellow, darker on sides; pretergites light yellow. Mesonotal præscutum and scutum dark gray; pseudosutural foveæ dark red, inconspicuous against the ground; scutellum obscure yellow, the basal portion darkened medially; postnotum gray. Pleura brownish black, with a conspicuous, whitish, longitudinal stripe extending from the fore coxæ to the base of

abdomen; ventral sternopleurite and meron darkened; pteropleurite and pleurotergite somewhat paler brown than the anterior sclerites. Halteres yellow, the knobs weakly darkened basally. Legs with the fore coxæ whitened, middle and posterior coxæ darker basally, the tips pale; femora yellow, with a narrow, dark brown, subterminal ring, this subequal to or narrower than the yellow apex; tibiæ yellow; tarsi broken. Wings (Plate 1, fig. 17) with a grayish tinge, the costal border and apex whitened, the latter including the distal ends of cells R_4, R_5, and 2d M_2 as far basad as the level of the tip of vein R_4; stigma small, oval, brown, interrupting the white costal border; restricted darker areas at arculus, origin of Rs, along cord and outer end of cell 1st M_2, and as a seam on vein R_3; veins pale, darker in the infuscated areas, more whitened in the pale portions of the wing. Costal fringe pale, relatively long and conspicuous; rather numerous macrotrichia on veins R_{2+3+4}, R_4, distal section of R_5, and distal sections of M_{1+2} and M_3; a few trichia at extreme outer end of vein 2d A. Venation: Sc_1 ending opposite origin of the long Rs, Sc_2 close to its tip; Rs subequal in length to stem of cell R_3; vein R_3 very short, perpendicular; cell R_2 at margin considerably more extensive than cell R_3; vein R_4 rather strongly upcurved at margin; m-cu shortly before fork of M.

Abdominal tergites black, the caudal borders of the segments narrowly yellow; sternites somewhat more grayish black, the pale borders narrower. Cerci horn-colored, darkened basally.

Habitat.—China (Hainan Island).

Holotype, female, Ta Han, altitude 2,500 feet, June 21, 1935 (*Gressitt*).

Gonomyia (*Lipophleps*) *conquisita* is readily told from other members of the group that are closely allied to *nubeculosa* (de Meijere), including *pallidisignata* Alexander, by the narrow brown femoral rings. In all species of the group hitherto described, these annuli are black, very broad, and preceded and followed by narrow whitened rings.

GONOMYIA (LIPOPHLEPS) PALLICOSTATA sp. nov. Plate 1, fig. 18; Plate 2, fig. 29.

Allied to *bicolorata;* femora brown, the extreme tip abruptly pale; wings suffused with brown, the costal and apical portions narrowly white, the remainder of membrane more or less variegated by paler areas; stigma oval, dark brown; Sc short, Sc_1 ending before origin of Rs a distance nearly equal to the length of the latter vein; male hypopygium with two dististyles, the outer one bilobed, its outer arm a long, slender, simple rod, the

inner arm a densely hairy cushion; inner style terminating in a curved spine and bearing a second, very long spine on outer margin at near midlength.

Male.—Length, about 3.2 to 3.4 millimeters; wing, 3.5 to 3.8.

Female.—Length, about 4 millimeters; wing, 4.

Rostrum and palpi black. Antennæ with the scape and pedicel yellow, flagellum black; flagellar segments (male) with unusually elongate verticils. Head chiefly yellow; badly flexed in types, but apparently with central darkening on posterior vertex.

Pronotum and lateral pretergites pale yellow, the former darkened on sides. Mesonotal præscutum and scutum almost uniformly dark brown, the pseudosutural foveæ black; scutellum black basally, obscure brownish yellow behind; mediotergite blackened, the anterolateral portions obscure yellow. Pleura chiefly dark brown, somewhat paler dorsally on the pteropleurite and pleurotergite, and ventrally on the ventral sternopleurite; a broad white longitudinal stripe extends from the fore coxæ across the dorsal sternopleurite, ventral pteropleurite, and meral area to base of abdomen. Halteres yellow, the lower face of knob dusky. Legs with the coxæ pale, their basal portions dark brown, the fore coxæ more uniformly whitened; trochanters testaceous-yellow; femora brown, somewhat darker outwardly, the extreme tip abruptly pale; tibiæ and tarsi brown. Wings (Plate 1, fig. 18) almost uniformly suffused with brown, the costal border and apex conspicuously china white, the degree nearly uniform throughout the area except before the stigma where the pale crosses Rs into cell R; stigma oval, dark brown; dusky ground color slightly variegated by paler areas, as in many allied forms; veins brownish yellow, paler, almost white, in the anterior pale portion. Costal fringe sparse, but long and conspicuous. Venation: Sc short, Sc_1 ending far before origin of Rs, the distance on costa nearly as long as Rs alone; branches of Rs divergent; cell R_5 narrowed at margin; m-cu a short distance before fork of M.

Abdominal tergites dark brown, the posterolateral angles yellow, more broadly and conspicuously so on outer segments; subterminal segment more uniformly darkened; hypopygium yellowish brown. Male hypopygium (Plate 2, fig. 29) with two terminal dististyles; outer style, *od,* bilobed, the outer arm a simple, slender, blackened rod, a little longer than the basistyle; inner lobe more than one-half as long as the outer, fleshy, the distal half with abundant yellow setæ. Inner dististyle, *id,*

small, terminating in a slender, curved, acute spine; on outer margin at near midlength produced into a second, very long, nearly straight spine that exceeds the style in length, its base dilated. Phallosome, *p*, with two divergent subapical lobes, the tips with microscopic setæ.

Habitat.—China (Hainan Island).

Holotype, male, Ta Han, altitude 2,500 feet, June 23, 1935 (*Gressitt*). Allotype, female, Ta Hian, altitude 2,000 feet, June 19, 1935 (*Gressitt*). Paratype, male, Liamui, altitude about 1,200 feet, August 3, 1935 (*Gressitt*).

The nearest described ally is *Gonomyia* (*Lipophleps*) *bicolorata* Alexander (Luzon, Hainan), which is similar in general appearance, but the structure of the male hypopygium is very different.

GONOMYIA (LIPOPHLEPS) PULVINIFERA sp. nov. Plate 1, fig. 19; Plate 2, fig. 30.

Mesonotum brownish black, sparsely pruinose; scutellum yellow, darkened medially at base; thoracic pleura with a longitudinal yellow stripe; femora infuscated, with a broad, blackish, subterminal ring, preceded and followed by narrow, clearer yellow annuli; tibiæ and tarsi black; wings grayish subhyaline, the costal border whitened, the disk with extensive brown clouds; Sc short; male hypopygium with the outer dististyle a long blackened rod, its distal fifth expanded and densely set with a cushion of spines.

Male.—Length, about 3.5 millimeters; wing, 3.6 to 3.7.

Rostrum obscure brownish yellow; palpi black. Antennæ black, the scape more or less brightened. Head orange-yellow, variegated by brownish black on central portion of disk.

Mesonotum brownish black, sparsely pruinose; pseudosutural foveæ black; scutellum yellow, darkened medially at base; postnotum more heavily pruinose. Pleura brownish black, the dorsal pteropleurite and pleurotergite more infuscated; a relatively narrow but conspicuous, pale yellow, longitudinal stripe extending from the fore coxæ to the base of abdomen, passing beneath the root of halteres, this stripe narrowly bordered dorsally by a dark stripe. Halteres yellow, most of the knobs infuscated. Legs with the coxæ darkened basally, paler at tips; trochanters brownish testaceous; femora infuscated, the distal third more yellowish, inclosing a broad, more-blackened subterminal ring, the actual tip and postmedian pale annulus much narrower; posterior femora with long erect setæ; tibiæ and tarsi brownish black. Wings (Plate 1, fig. 19) with the ground color grayish subhyaline, variegated by more brownish clouds near wing base,

across outer ends of cells R to 1st A, inclusive, and beyond the cord; costal border and conspicuous areas before and beyond stigma white; stigma oval, pale brown; veins pale brown, still paler in the brightened costal portions, darker along cord. Costal fringe relatively long and conspicuous; trichia of veins beyond cord relatively abundant. Venation: Sc short, Sc_1 ending some distance before origin of Rs, the distance on C being about two-thirds the length of Rs alone; r-m long, gently arcuated.

Abdomen blackened, the caudal borders of both tergites and sternites restrictedly paler; hypopygium large, more chestnut-brown, the conspicuous outer dististyle black. Male hypopygium (Plate 2, fig. 30) with the two dististyles terminal in position. Outer dististyle, *od*, a long, nearly straight, blackened rod that is considerably longer than the basistyle, on apical fifth a little dilated and bearing a dense brush or cushion of spines; outer surface of stem of style with abundant spinous points or teeth. Inner dististyle, *id*, small, simple, long, and slender. Phallosome, *p*, not clearly evident in material studied, consisting of flattened pale cushions and a single, acute, smooth black spine.

Habitat.—Assam (Khasi Hills).

Holotype, male, Cherrapunji, altitude 4,000 feet, August, 1935, at light (*Sircar*). Paratopotype, 2 males.

By Edwards's key to the Oriental species of *Lipophleps*,[6] the present fly runs to *subnebulosa* Edwards, a quite different species with the wing pattern distinct. As usual in the genus, the male hypopygium offers the chief feature for the separation of the species from allied forms.

GONOMYIA (LIPOPHLEPS) SIRCARI sp. nov. Plate 1, fig. 20; Plate 2, fig. 31.

General coloration dark brownish gray; scutellum obscure yellow on posterior border; pleura with a light yellow longitudinal stripe; legs dark brown; posterior femora with a series of more than a score of erect setæ; wings with a faint brown tinge, the disk slightly variegated by more grayish subhyaline areas; Sc short; male hypopygium with the outer dististyle a simple rod; inner dististyle bearing two long, slender, pale arms, each tipped with a small blackened spine; phallosome with appressed spinulose points.

Male.—Length, about 3 millimeters; wing, 3.3.

Rostrum and palpi black. Antennæ black throughout. Head above orange-yellow, the central portion of vertex more darkened.

[6] Journ. Fed. Malay St. Mus. 14 (1928) 104–105.

Pronotum and anterior lateral pretergites yellow. Mesonotal præscutum and scutum uniformly dark brownish gray, without markings; scutellum obscure yellow on the posterior border, broadly darkened medially at base; postnotum obscure yellow on cephalic half, the posterior portion darkened. Pleura with the dorsopleural membrane and most of pteropleurite and pleurotergite obscure yellow, the more ventral pleurites brownish gray, with a conspicuous light yellow longitudinal stripe extending from and including the fore coxæ, reaching the base of abdomen. Halteres dusky, with most of the knob light yellow. Legs with the fore coxæ yellow, the remaining coxæ and all trochanters more testaceous; remainder of legs dark brown; posterior femora with an evenly spaced series of more than a score of long erect setæ, additional to the usual appressed vestiture. Wings (Plate 1, fig. 20) with a faint brownish tinge, the prearcular and costal portions more clearly yellow; stigma small, oval, a little darker than the ground color; disk variegated by more grayish subhyaline areas on the posterior half of wing, the radial field more uniformly pale brown; veins pale brown, a little lighter in the costal and prearcular fields. Costal fringe moderately long, at base with setæ very sparse and tiny; anterior branch of Rs without trichia; R_5 and all outer branches of M with numerous trichia. Venation: Sc short, Sc_1 ending some distance before origin of Rs, the distance on C equal to about two-thirds the length of Rs; Rs only a little shorter than its anterior branch, the latter directed strongly cephalad, so cell R_4 at margin is very wide; m-cu close to fork of M.

Abdominal tergites dark brown, the incisures restrictedly paler; sternites and hypopygium more yellowish. Male hypopygium (Plate 2, fig. 31) with two dististyles, both terminal in position. Outer style, *od*, a simple sinuous rod, the base with a small mesal flange, the central third of the blade a little wider, the apex obtuse. Inner style, *id*, bearing two, long, slender, pale arms, each tipped with a small blackened spine; outer rod a little longer than the inner, the latter bearing two spines on one side and only one on the other (of the unique type, probably abnormal, and the condition may be normally unispinous). Phallosome, *p*, appearing as two divergent, flattened, black horns that run out into smooth black spines, the surface microscopically serrulate and provided with appressed spinulose points.

Habitat.—Assam (Khasi Hills).

Holotype, male, Cherrapunji, altitude 4,000 feet, August, 1935, at light (*Sircar*).

I take great pleasure in naming this distinct crane fly in honor of the collector of this interesting series of Tipulidæ from the Khasi Hills, Mr. S. Sircar. The species is readily distinguished from other, generally similar, allied species in this faunal area, such as *flavomarginata* Brunetti and *nissoriana* sp. nov., by the structure of the male hypopygium.

GONOMYIA (LIPOPHLEPS) NISSORIANA sp. nov. Plate 1, fig. 21; Plate 2, fig. 32.

General coloration dark brown; scutellum obscure yellow, darkened medially at base; pleura with a clear yellow longitudinal stripe; knobs of the halteres darkened; legs brownish black; wings with a faint brown tinge, the costal border whitened; stigma and narrow seams along cord and outer end of cell 1st M_2 vaguely seamed with pale brown; Sc short; abdominal tergites uniformly dark brown, the sternites and hypopygium yellow; male hypopygium with both dististyles terminal in position, the inner at apex produced into a long yellow arm that is tipped with a small black spine and bears a single very long bristle that is longer than the arm itself.

Male.—Length, about 2.7 millimeters; wing, 3.

Rostrum and palpi black. Antennæ with the scape black, pedicel chiefly orange, flagellum black. Head light yellow, the central portion of vertex weakly darkened.

Pronotum and the lateral pretergites light yellow. Mesonotal præscutum and scutum dark brown, the surface sparsely pruinose; pseudosutural foveæ reddish brown; scutellum obscure yellow, the base darkened; mediotergite extensively obscure yellow, darkened behind and on sides. Pleura with dorsal sclerites and membrane brownish yellow; a broad, clear yellow, longitudinal stripe extending from the fore coxæ to the base of abdomen, passing beneath the halteres, narrowly bordered above by darker brown; ventral sternopleurite darkened. Halteres with the stem dusky, the knob yellow. Legs with the coxæ testaceous, the fore pair somewhat clearer; remainder of legs brownish black; posterior femora with moderately erect setæ along the entire length. Wings (Plate 1, fig. 21) with a faint brown tinge, the prearcular and costal portions more whitened; stigma long-oval, slightly darker brown than the ground; cord and outer end of cell 1st M_2 vaguely seamed with pale brown, best indicated by a darkening of the veins; veins brown, more yellowish in the whitened areas. Anterior branch of Rs without trichia; R_5 and all outer branches of M with numerous trichia. Venation: Sc short, Sc_1 ending some distance before origin of Rs, the distance on C about one-half Rs; anterior

branch of Rs directed rather strongly cephalad so cell R_2 at margin is only a little more than one-third as extensive as cell R_4; m-cu at fork of M.

Abdominal tergites uniformly dark brown; sternites and hypopygium yellow. Male hypopygium (Plate 2, fig. 32) with the two dististyles terminal in position, the outer style, *od,* a glabrous darkened blade, shaped more or less like a cleaver, the margins smooth. Inner dististyle, *id,* at apex extended into a long, slender, yellow arm that is tipped with a small black spine and a single very long seta that is longer than the arm itself; the arm at near midlength bears a dense group of short setæ. Phallosome, *p,* consisting of coiled yellow rods that terminate in a dense brush of setæ.

Habitat.—Assam (Khasi Hills).

Holotype, male, Cherrapunji, altitude 4,000 feet, August, 1935, at light (*Sircar*).

I take much pleasure in naming this distinct species in honor of Mr. Nissor Singh, veteran collector of the Himalayan Butterfly Company, who celebrated his eighteith birthday in December, 1935. The fly is allied to species such as *Gonomyia* (*Lipophleps*) *sircari* sp. nov., and *G.* (*L.*) *luteimarginata* Alexander, differing very conspicuously from all described forms in the structure of the male hypopygium.

CRYPTOLABIS (BÆOURA) DICLADURA sp. nov. Plate 1, fig. 22; Plate 2, fig. 33.

General coloration dark gray, the scutellum yellow, darker medially at base; legs with short setæ; wings with a slight grayish tinge, the stigmal region weakly suffused; prearcular and costal regions more whitened; cell 2d A wide, vein 2d A deflected caudad on its distal third; male hypopygium with the dististyles subterminal in position, profoundly bifid, the inner arm longer than the outer.

Male.—Length, about 3.5 millimeters; wing, 3.8.

Female.—Length, about 3.6 millimeters; wing, 4.

Rostrum dull black; palpi infuscated. Antennæ dark throughout; pedicel black; outer flagellar segments elongate. Head uniformly gray.

Pronotum yellowish white. Mesonotal præscutum and scutum almost uniformly dark gray, or blackish with a relatively sparse pruinosity; scutellum yellow, darker medially at base; postnotum gray. Pleura dark brownish gray, the dorsopleural region yellow. Halteres pale, the knobs darkened. Legs with the coxæ and trochanters testaceous-brown; femora obscure yellow, the tips infuscated; tibiæ and tarsi brownish black; vestiture of legs

short and appressed, inconspicuous. Wings (Plate 1, fig. 22) with a slight grayish tinge, the stigmal region weakly suffused; a vague darkened seam along cord, best indicated by a more intense coloring of the veins traversed; prearcular and costal regions more whitened; veins brown, pale in the whitened areas. Costal fringe relatively long and conspicuous. Venation: R_2 a little shorter than R_{2+3}; m-cu at near midlength of M_{3+4}; cell 2d A wide, the vein deflected caudad on its distal third.

Abdomen dark brown, the hypopygium brightened. Male hypopygium (Plate 2, fig. 33) with the ninth tergite, 9*t*, having each outer lateral angle produced into a slender straight point; median area of tergite slightly produced, the caudal border gently concave. Dististyle, *d*, subterminal in position, long and slender, profoundly bifid, the outer arm only about one-half as long as the inner but somewhat stouter. Ædeagus, *a*, terminating in a very long needlelike point.

Habitat.—China (Hainan Island).

Holotype, male, Ta Hian, altitude 2,000 feet, June 11, 1935 (*Gressitt*). Allotopotype, female. Paratopotype, 1 female.

Compared with other similar regional species of *Bæoura* that have the wings broad, cell 2d A wide, inconspicuously hairy legs, and conspicuously brightened scutellum, the present fly is readily told by the somewhat remarkable male hypopygium, especially the dististyle.

CRYPTOLABIS (BÆOURA) SETOSIPES sp. nov. Plate 1, fig. 23; Plate 2, fig. 34.

Belongs to the *trichopoda* group; general coloration black; scutellum obscure yellow; wings with a dusky tinge, the costal border more whitened; a broad dark seam along cord; cell 2d A narrow; male hypopygium with the lateral angles of the tergite extended caudad into narrow arms; dististyle deeply bilobed, the inner arm slender.

Male.—Length, about 3.3 millimeters; wing, 4.

Female.—Length, about 3.5 millimeters; wing, 4.

Rostrum testaceous; palpi brown. Antennæ apparently 14-segmented, short, dark brown; flagellar segments passing through short-cylindric into long-cylindric; terminal segment longer than the penultimate, constricted at near midlength; verticils very long and conspicuous. Head light gray; setæ and punctures conspicuous.

Pronotum testaceous-gray. Mesonotal præscutum dull black, the humeral region scarcely brightened; scutum, including median area, dull black; scutellum obscure yellow, darker medially at base, parascutella black; mediotergite dark, heavily gray

pruinose. Pleura black, heavily pruinose; dorsopleural membrane paler. Halteres dusky, the base of stem restrictedly brightened, the knobs a little paler. Legs with the fore coxæ black, the middle and hind coxæ a little paler; trochanters testaceous-yellow; femora brown; tibiæ and tarsi brownish black; segments with very long erect setæ, as in the group; claws (male) very long and slender, each with a long, pale, erect seta or setoid spine at base. Wings (Plate 1, fig. 23) with a dusky tinge, the entire costal border both before and beyond the stigma whitened; stigma and a broad confluent seam along the cord darker than the ground; basal portions of wing a trifle infumed; veins dark, paler in the whitened costal portions. Venation: Sc_1 ending opposite cord, Sc_2 not far from its tip; cell 2d A narrow.

Abdomen, including hypopygium, brownish black. Male hypopygium (Plate 2, fig. 34) with the tergite, 9*t*, produced laterad and caudad into slender glabrous points; median portion of caudal border likewise produced into a low triangular point. What seems to be a part of the eighth sternite is represented by a slender pale structure that terminates in two strong modified setæ, suggesting the condition found in *Styringomyia*. Dististyle, *d*, terminal, deeply bifid, the broader outer arm with numerous setigerous punctures, including a dense group at apex; before tip, near inner margin of lobe, with two slender spines; inner arm nearly as long but much slenderer, with setæ only at apex. Ædeagus, *a*, broadly depressed, except on apical portion.

Habitat.—China (Hainan Island).

Holotype, male, Ta Hian, altitude 2,000 feet, June 11, 1935 (*Gressitt*). Allotype, female, Liamui, altitude about 1,200 feet, July 31, 1935 (*Gressitt*). Paratopotype, female.

In its hypopygial structure, *Cryptolabis* (*Bæoura*) *setosipes* is very different from the other members of the *trichopoda* group described to this date.

CRYPTOLABIS (BÆOURA) CONSONA sp. nov. Plate 2, fig. 35.

Belongs to the *trichopoda* group, closely allied to *setosipes;* male hypopygium with the outer lateral angles of tergite produced caudad into very long, slender blades, the tips subacute; dististyle simple, appearing as an elongate blade, narrowed outwardly to the obtuse tip, on outer face at near two-thirds the length with a small peglike spine.

Male.—Length, about 3.3 millimeters; wing, 4.

Female.—Length, about 3.5 millimeters; wing, 4.

Rostrum and palpi dark. Antennæ of moderate length, dark throughout, apparently 15-segmented; basal flagellar segments

short-oval, the outer segments more elongate, with very long, conspicuous verticils. Head gray.

Mesonotum dull black, the surface very sparsely pruinose; scutellum obscure brownish yellow, the base darkened medially; postnotum more heavily pruinose. Halteres weakly suffused with dusky, especially the central portion of stem. Legs with the coxæ brownish testaceous; trochanters obscure yellow; femora brown; tibiæ obscure yellow, the tip narrowly darkened, especially the distal portions of posterior legs; tarsi brown, passing into black outwardly; segments of legs with very long conspicuous setæ, as in the group. Wings with a strong dusky tinge, the costal region more whitish; a darkened cloud along cord; basal cells slightly infumed, leaving rather clearer areas before and beyond the cord; stigma a little darker; veins dark, somewhat paler in the costal field. Venation: Virtually identical with that of *setosipes;* cell 2d A a trifle narrower.

Abdomen, including hypopygium, brownish black. Male hypopygium (Plate 2, fig. 35) with the outer lateral angles of tergite, 9*t*, produced caudad into very long, slender blades, the tips subacute; caudal margin between the horns transverse or very slightly protuberant, not produced into a point as in *setosipes*. Dististyle, *d*, simple, appearing as an elongate blade that narrows outwardly, the tip obtuse; outer face of style at near two-thirds the length with a small peglike spine; before apex of style, near inner margin, with two or three small spinous points, as in *setosipes*.

Habitat.—China (Hainan Island).

Holotype, male, Dwa Bi, altitude about 1,500 feet, July 21, 1935 (*Gressitt*). Allotopotype, female.

Cryptolabis (*Bæoura*) *consona* is very similar in its general appearance to *C.* (*B.*) *setosipes* sp. nov., but is entirely distinct in the structure of the male hypopygium.

STYRINGOMYIA HOLOMELANIA sp. nov. Plate 1, fig. 24; Plate 2, fig. 36.

Entire body black; halteres and legs black, the tarsal segments slightly paler on basal portions; wings narrow, whitish subhyaline, the cord and vein Cu seamed with brown; anterior branch of Rs oblique; male hypopygium with the basistyle bearing two spines, the inner one only half the length of the outer; outer lobe of dististyle with a dense group of spines near base; tenth tergite with median lobe very slender; ninth sternite bilobed at apex.

Male.—Length, about 5 millimeters; wing, 3.4.

Rostrum and palpi black. Antennæ black, the outer flagellar segments a trifle paler. Head black.

Thorax entirely black, including the coarse but unmodified setæ. Halteres black. Legs black, the basal three tarsal segments a very little paler on their proximal portions. Wings (Plate 1, fig. 24) narrow, whitish subhyaline, the cord and vein Cu seamed with brown; veins brown. No macrotrichia on veins behind R_1 excepting a complete series of about twenty-two on vein R_5 and an isolated bristle on anterior branch of Rs; two or three trichia on outer ends of distal sections of medial veins. Venation: Anterior branch of Rs oblique; cell 1st M_2 long and narrow, exceeding any of the veins beyond it; m-cu sinuous, at near one-third the length of cell 1st M_2; vein 2d A unspurred but strongly curved near outer end.

Abdomen black throughout. Male hypopygium (Plate 2, fig. 36) with the basistyle, *b*, bearing two unequal spines on a short apical lobe, the outer spine about twice the length of the inner, flattened on basal half; inner spine obtuse at apex. Tip of basistyle with an acute blackened spine that is directed mesad. Outer lobe, *od*, of dististyle relatively stout, bearing a dense group or comb of equal black spines on mesal face near base; inner lobe, *id*, produced into two arms. Tenth tergite, *t*, with the median lobe very slender, appearing as a ligulate structure clothed with abundant erect setæ. Ninth sternite, 9*s*, bilobed at apex, each lobe obtusely rounded, the median notch acute; the two usual modified setæ placed basally on lobes, unusually slender and more or less decussate.

Habitat.—Assam (Khasi Hills).

Holotype, male, Cherrapunji, altitude 4,000 feet, August, 1935, at light (*Sircar*).

Styringomyia holomelania is very different from all described species that have bispinous basistyles on the male hypopygium. The uniformly black coloration of the body, halteres, femora, and tibiæ provide characters that separate the fly from all species of the genus hitherto described. It seems to be most nearly allied to *S. obscura* Brunetti, yet is amply distinct in the coloration of the body, wings, and legs.

ILLUSTRATIONS

[*a*, Ædeagus; *b*, basistyle; *d*, dististyle; *dd*, dorsal dististyle; *id*, inner dististyle; *od*, outer dististyle; *p*, phallosome; *s*, sternite; *t*, tergite; *vd*, ventral dististyle.]

Plate 1

Fig. 1. *Longurio hainanensis* sp. nov., venation.
2. *Nephrotoma hainanica* sp. nov., venation.
3. *Phalacrocera tarsalba* sp. nov., venation.
4. *Limonia* (*Gressittomyia*) *xenoptera* sp. nov., venation.
5. *Limonia* (*Limonia*) *calcarifera* sp. nov., venation.
6. *Limonia* (*Libnotes*) *quinque-costata* sp. nov., venation.
7. *Antocha* (*Antocha*) *flavidula* sp. nov., venation.
8. *Antocha* (*Antocha*) *khasiensis* sp. nov., venation.
9. *Pseudolimnophila concussa* sp. nov., venation.
10. *Pseudolimnophila seticostata* sp. nov., venation.
11. *Hexatoma* (*Euhexatoma*) *triphragma* sp. nov., venation.
12. *Hexatoma* (*Eriocera*) *tuberculata* sp. nov., venation.
13. *Hexatoma* (*Eriocera*) *hirtithorax* sp. nov., venation.
14. *Elephantomyia* (*Elephantomyodes*) *angusticellula* sp. nov., venation.
15. *Trentepohlia* (*Mongoma*) *hainanica* sp. nov., venation.
16. *Gonomyia* (*Ptilostena*) *hainanensis* sp. nov., venation.
17. *Gonomyia* (*Lipophleps*) *conquisita* sp. nov., venation.
18. *Gonomyia* (*Lipophleps*) *pallicostata* sp. nov., venation.
19. *Gonomyia* (*Lipophleps*) *pulvinifera* sp. nov., venation.
20. *Gonomyia* (*Lipophleps*) *sircari* sp. nov., venation.
21. *Gonomyia* (*Lipophleps*) *nissoriana* sp. nov., venation.
22. *Cryptolabis* (*Bæoura*) *dicladura* sp. nov., venation.
23. *Cryptolabis* (*Bæoura*) *setosipes* sp. nov., venation.
24. *Styringomyia holomelania* sp. nov., venation.

Plate 2

Fig. 25. *Limonia* (*Gressittomyia*) *xenoptera* sp. nov., male hypopygium.
26. *Antocha* (*Antocha*) *flavidula* sp. nov., male hypopygium.
27. *Antocha* (*Antocha*) *khasiensis* sp. nov., male hypopygium.
28. *Pseudolimnophila concussa* sp. nov., male hypopygium.
29. *Gonomyia* (*Lipophleps*) *pallicostata* sp. nov., male hypopygium.
30. *Gonomyia* (*Lipophleps*) *pulvinifera* sp. nov., male hypopygium.
31. *Gonomyia* (*Lipophleps*) *sircari* sp. nov., male hypopygium.
32. *Gonomyia* (*Lipophleps*) *nissoriana* sp. nov., male hypopygium.
33. *Cryptolabis* (*Bæoura*) *dicladura* sp. nov., male hypopygium.
34. *Cryptolabis* (*Bæoura*) *setosipes* sp. nov., male hypopygium.
35. *Cryptolabis* (*Bæoura*) *consona* sp. nov., male hypopygium.
36. *Styringomyia holomelania* sp. nov., male hypopygium.

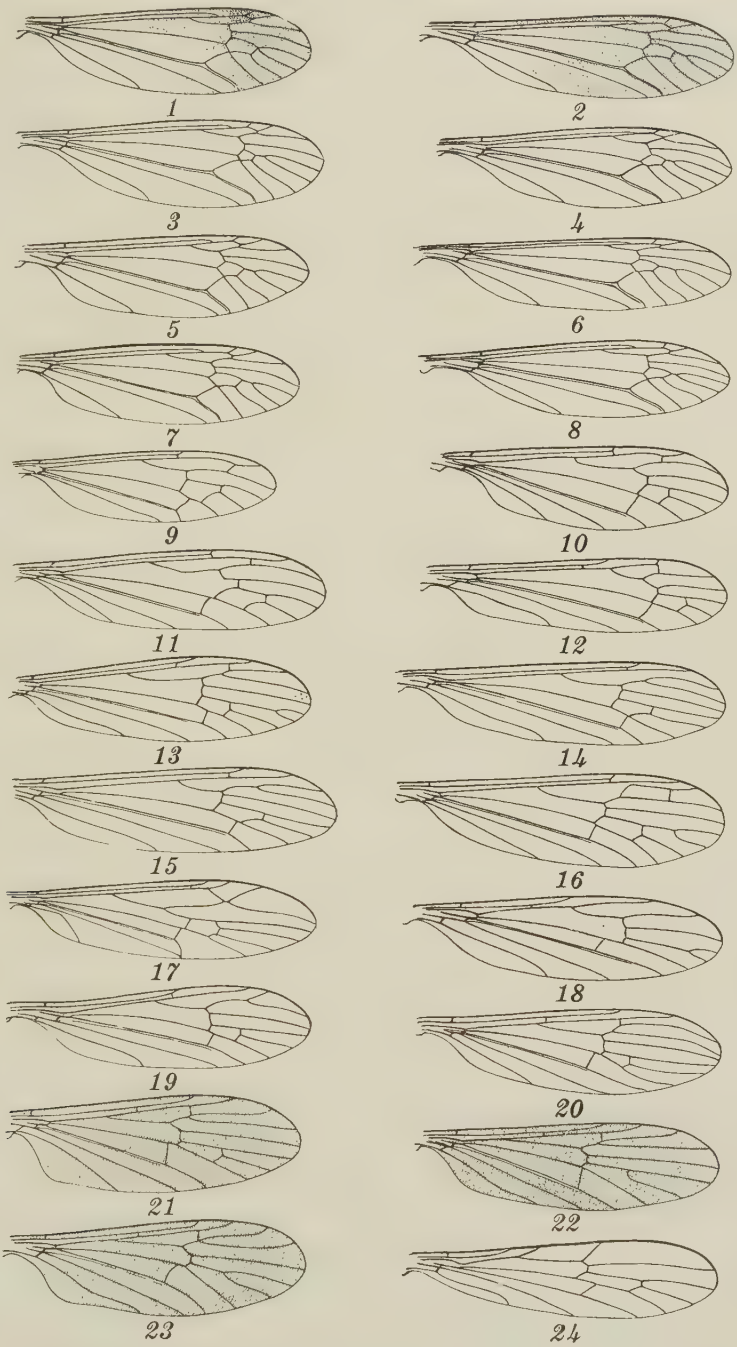

PLATE 1.

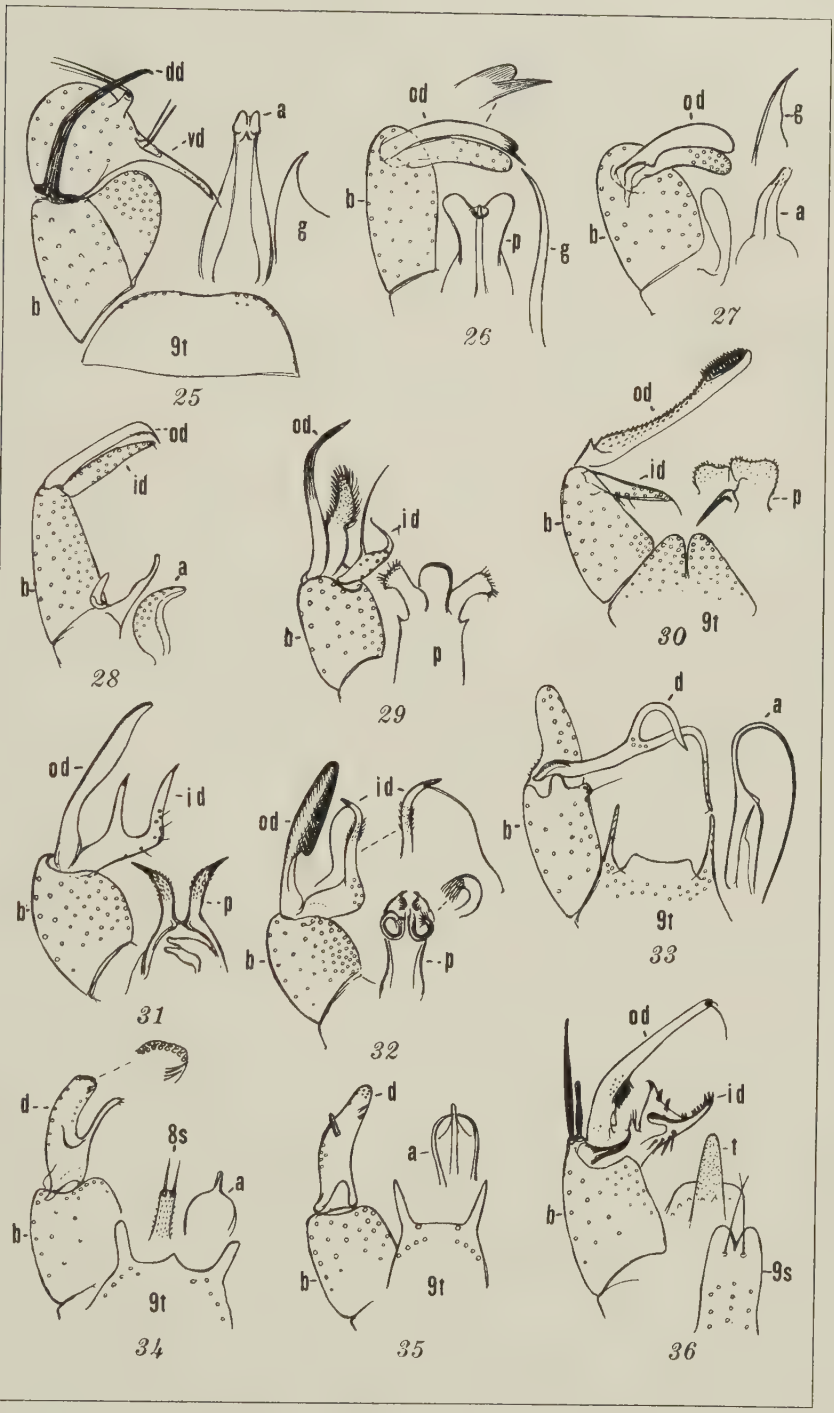
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PLATE 2.

BOOKS

Acknowledgment of all books received by the Philippine Journal of Science will be made in this column, from which a selection will be made for review.

RECEIVED

JULY 1, 1936

BUSCHKE, ABRAHAM, and F. JACOBSOHN. Sex habits; a vital factor in well-being. Tr. from the German by Eden and Cedar Paul. N. Y., Emerson books, 1933. xiii + 190 pp., illus. Price, $2.50.

DUKES, H. H. The physiology of domestic animals. 3d rev. ed. Ithaca, N. Y., Comstock publishing co., 1935. xiv + 643 pp., illus., tables, diagrs. Price, $6.

HARROWER, H. R. Three lectures on endocrinology in everyday practice. Glendale, California, The Harrower laboratory. [c. 1936.] 62 pp. Price, $1.

HARVEY, WM. CLUNIE, and HARRY HILL. Milk production and control, by Wm. Clunie Harvey and Harry Hill. London, H. K. Lewis & co., 1936. 555 pp., illus. Price, $10.50.

HODSON, Mrs. CORA B. S. Human sterilization to-day; a survey of the present position. London, Watts & co., 1934. vii + 55 pp. Price, $0.25.

International institute of agriculture. Rome. The world agricultural situation in 1933–34. (World agriculture; conditions and trends; markets and prices. Agricultural policies and conditions in the different countries.) Economic commentary on the International yearbook of agricultural statistics for 1933–34. Rome, 1935. viii + 502 pp., tables. Price, $2.50.

JEFFREYS, HAROLD. Earthquakes and mountains. London, Methuen & co., 1935. x + 183 pp., front., plates, diagrs. Price, $2.

JOHN, H. J. Diabetic manual for patients. 2d ed. St. Louis, Missouri, The C. V. Mosby co., 1934. 232 pp., front., illus., tables, diagrs. Price, $2.

LORD, F. T. Lobar pneumonia and serum therapy; with special reference to the Massachusetts pneumonia study [by] Frederick T. Lord and Roderick Heffron. N. Y., The Commonwealth fund, 1936. 91 pp., illus., plate, diagrs. Price, $1.

RITSHER, W. H. Criteria of capacity for independence. Jerusalem, Syrian orphanage press, 1934. ix + 152 pp. Price, $2.

REVIEWS

The Bacteriological Grading of Milk. By G. S. Wilson. Medical Research Council, Special Report Series, No. 206. His Majesty's Stationary Office, London, 1935. 392 pp. Price, $2.

This book gives the results of the author's critical studies on the various technical procedures that have been heretofore used

in the examination of milk. The usefulness of these procedures is discussed extensively with recommendations on the methods that should be followed.

A description of the modified methylene blue reduction test is given, and, according to the author, the test seems to fulfill most of the requirements demanded of the routine grading of raw milk. It gives more information about the milk than does the plate count, the performance of which requires an elaborate procedure by highly skilled workers. According to him the plate count seems to afford no better index of the sanitary conditions of production or of the keeping quality of the milk than the Breed test or the modified methylene blue test. The latter test could be advantageously applied even to certified milk.

Whether the test is suitable for the examination of freshly pasteurized milk or not is doubtful, but there is reason to believe that it could well replace the plate count on bottle samples delivered to the consumer.

Finally, it is recommended that whatever test is used no attempt should be made to divide milk into more than three or four classes. From the public-health point of view probably only two divisions need be made on the basis of cleanliness; namely, (*a*) milk that is suitable and (*b*) milk that is not suitable for human consumption in the liquid state.—T. R. R.

The World Economic Survey, 1934–35. Fourth Year. Economic Intelligence Service, League of Nations, Geneva, Switzerland, 1935. 310 pp. Price, $2.

The book is an extensive review of the world economic and financial developments up to July, 1935, being the fourth of an annual series published by the League of Nations. The significant events featured in the international economic commotion during the last few years being presented in a comprehensive and coherent manner, this survey surely is indispensable to anyone who desires to gain a full grasp of the world economic situation. Considerable emphasis is laid on the subjects of currency, production, overseas trade, unemployment, and industrial recovery. Statistical tables, indices, and graphs are widely distributed from cover to cover, with the corresponding explanations so given as to be intelligible to the lay reader.

The opening chapter presents a kaleidoscopic view of the chaotic state of economic affairs the world over in 1934. Various steps undergone by the government towards the solution of the problems in finance and trade are mentioned as each country is surveyed. The movement of agricultural and industrial

prices is graphically dramatized by charts and tables. Statistical data of different countries illustrate impressively the law of supply and demand as it affects production, prices, and consumption. With the dawn of industrial recovery is treated the question of unemployment and stability of wages. The rôle played by the National Recovery Act, of all movements, is mentioned in this connection. The recent adjustments in international trade and equilibrium and the expanding basis of credit are equally dealt with comprehensively. The last chapter reviews the more recent constantly changing scenes in the world economic "movies," prominent among them being the "New Deal" program which has become linked with the Roosevelt administration.

The work is well indexed, and on the last pages is appended a chronological list of important world economic events from August, 1934, to July, 1935.—L. M. G.

Milk Production and Control. By W. C. Harvey and Harry Hill. H. K. Lewis & Co. Ltd., London, 1936. 555 pp., illus. Price, $10.50.

This book is a welcome addition to dairy literature. As the title indicates, special attention is given to the different phases of production and control of milk. Although the book was specially written for present conditions in England, much can be learned from its chapters to help those directly connected with the production and distribution of milk and its supervision in any country.

The first chapter deals with the composition of milk and its food value and rightly serves as an introduction to the entire subject herein treated. The second chapter, Milk and Disease, discusses briefly the various diseases transmitted to man in milk. The authors mention several outbreaks to emphasize the importance of milk in its relation to human health. The chapters on the cow and the cow shed discuss briefly the proper care and housing of milk cows. Dairy equipment, actual milk production, and proper distribution are also discussed, with appropriate illustrations, in separate chapters.

A long chapter is devoted to the treatment of milk by heat. Here the different processes of pasteurization of milk and the problems connected with each process are discussed. Stassanization, sterilization, and irradiation of milk are also mentioned in this chapter. Another long chapter, devoted to laboratory and other control, is a good guide for students, health inspectors, and laboratory technicians connected with the inspection of milk.

In the chapters on designated milk and legislative control, the reader can easily follow the development of the dairy industry in England.

Milk Production and Control is not only a good guide or reference book for people concerned with the production and distribution of milk and government officials connected with milk inspection, for whom the authors have written this work, but will also serve as a suitable textbook for classrooms.—S. Y. R.

Diabetic Manual for Patients. By H. J. John. Second Edition. The C. V. Mosby Company, St. Louis, 1934. 232 pp. Price, $2.

In this little book the author tries "to present clearly and briefly what the person with diabetes should know about the disease and its treatment in order that he may more fully and therefore more successfully coöperate with his physician." With this purpose in view the author explains the underlying laws and principles, the conscious or unconscious violation of which in some way or other produces the disease. He describes how it is acquired and the changes that take place in the body during the illness.

Since food plays an important rôle in the medical improvement of the patient, a good portion of this book is devoted to diet planned according to the modern trend of giving food more rich in carbohydrates. Thus the food values of different food products are given, the appendices being fully devoted to this purpose. The author also stresses the efficacy and necessity of insulin treatment, and unlike many physicians, encourages its use.

—I. F.

Who Shall Survive; a New Approach to the Problem of Human Interrelations. By J. L. Moreno. Washington, D. C., Nervous and Mental Disease Publishing Co., 1934. 437 pp., diagrs. Price, $4.

Who Shall Survive deals with the study of the emotional relations among individuals who are functioning as a social group, or the cross-currents of emotion as they play back and forth between individuals. The material and illustrations are drawn from institutions and schools. The author develops a technic for a process of classification calculated to bring individuals together who are capable of harmonious interpersonal relationships, and creates a social group which can function at the maximum efficiency and with the minimum of disruptive tendencies and processes. He has rediscovered many homely truths by a different method which permits of their development to a more highly differentiated degree and also their utilization for the benefit of the individual. He differs from the psychoanalytic

approach in a significant way. While the analyst works backward to an explanation for the individual's conduct, he takes the individual's conduct as the starting point and works forward. All his various points of view, methods, and technic are of great significance. This is a good reference book on social problems.

—R. E. G.

The Student's Manual of Microscopic Technique; with Instructions for Photomicrography. By J. C. Tobias. American Photographic Publishing Co., Boston, Mass., 1936. 210 pp., illus. Price, $2.50.

This is a useful guide for students of anatomy and biology. It contains (*a*) a good chapter on the microscope, its care, uses, and the physical rationale of its operation, including the polarizing microscope; (*b*) another excellent chapter on the microscopic objects found in water and the modes of their examination; (*c*) several chapters on the commoner methods of preparing tissues for microscopic examination, including the principal procedures of sectioning, staining, etc., and their examinations microscopically in the fresh state and as permanent preparations; and (*d*) a special section on microphotography. Most of the principal topics are illustrated with excellent text figures.

The author has happily combined in one compact and convenient volume the principal methods of microscopic technic usually found in such standard works as Gage's, Lee's, Mallory and Wright's, and others. The book should have general acceptance as an excellent complement to ordinary textbooks of histology and pathology.—A. G.

Mountains and Earthquakes. By Harold Jeffreys. Methuen & Co. Ltd., London, 1935. 183 pp. Price, $2.

This book gives a comprehensive discussion of the latest developments in the study of the earth from the view points of the physicist, the geologist, and the geodesist. The presentation is well planned, and the language, though precise, is simple. The subject is probably too far advanced for the comprehension of the layman, but it is very interesting to the technical man who has a good working knowledge of mathematics, physics, and geology.—Q. A. A.

The Mental Health Emphasis in Education—A Qualitative Study. By H. C. Patey and G. S. Stevenson. The National Committee for Mental Hygiene, Inc., New York. 96 pp.

This treatise has for its working principle the idea that "basically the philosophy of mental hygiene and education are identical and may be stated in terms of complete living or satisfac-

tory functioning of the human organism." In terms of this principle it asserts that "at the present time the relationships of mental hygiene and education are confused by the fact that mental hygienists have given much of their attention to corrective therapy while educationalists have been concerned with fostering normal development without insight gained from observations of exaggerated functioning," and makes an effort to indicate methods of coördinating, articulating, and integrating the other agencies of society; namely, industry, business, law, social service, journalism, art, theology, and medicine, with education, in order for the latter "to realize all of the opportunities that lie within the scope of its own organization and objective." Perhaps too confident and optimistic, the authors claim that "the professional mental hygienist brings to each situation and interpretation intensive experience with the problems of individuals, with the purpose of bringing objectives to a focus in terms of what is most satisfying."—A. V. C.

Elementary Microtechnique. By H. Alan Peacock. Edward Arnold & Co., London, 1935. 200 pp. Price, $1.50.

This is an unassuming little book, which contains much useful information on microtechnic. It is intended primarily for beginners in histology and cytology, although advanced students equally will find the work a good reference book.

The book is introduced with a short summary of the structure of the cell and protoplasm, followed by brief descriptions of the processes of microtechnic. Chapters III and IV cover outlining methods and technic. There is an alphabetical list of special subjects with the various methods to be followed and their preparation in Chapter V; of stains and their uses in Chapter VI; and of formulæ and hints in Chapter VII. Three appendices are included, the last being a bibliography.—M. T.

Sex Practice in Marriage. By C. B. S. Evans. Second Edition. Emerson Books, Inc., New York, 1935. 128 pp. Price, $1.95.

This is a clear and simple exposition of a subject of vital interest to married couples and young people contemplating marriage who are seeking happiness. The book, which is so easy to read that it will but take few hours to finish, will not only help bring about a better understanding between husband and wife but also make for a better appreciation of each other's needs and problems. In serving as a guide in securing a happy mating, this book will help married people in solving their marital problems arising from ignorance of the proper functions

of sex, which will be conducive to harmony in the home, lessen friction, and minimize divorce. Likewise physicians will find the book a great help to their own method of handling related problems.—U. D. M.

Engineer-Custodians Manual. By Thomas J. Brett. American Technical Society, Chicago, 1934. 192 pp. $2.50.

This is a useful book for building superintendents, engineers, custodians, firemen, electricians, and others interested in the operation and maintenance of public buildings. It embodies valuable information that is usually required for passing competitive civil-service examinations; contains over 500 questions and answers on boilers, combustion engines, heating and ventilating, air-conditioning, pumps, sanitation, plumbing, electrical machinery, and mechanics; over 200 engineering formulas and tables, and general information. The book is fully indexed.

—R. M.

Diesel and other Internal-Combustion Engines. By Howard E. Degler. American Technical Society, Chicago, 1936. 237 pp. Price, $2.50.

This is practical text on the development, principles of operation, construction, details, and performance of stationary and portable diesel, gas, and gasoline engines.

In Part I the development and application, types, characteristics, efficiency, advantages, thermodynamics, and comparison of internal-combustion engines are set forth. Part II classifies fuels and fuel-air mixtures, gas producers, and liquid fuels and gives fuel-burning characteristics. Part III contains valuable information on automobile and aëroplane gas and gasoline engines. Part IV treats of low-pressure and moderate-pressure oil engines. Part V is devoted to heavy-duty diesel engines of various types. Part VI takes up high-speed diesel engines, their development and application. In Parts VII, VIII, IX, and X is found valuable information on diesel fuel-injection requirements and methods, engine parts, testing and testing methods, and economics of diesel power, respectively.—R. M.

Carpentry. By Gilbert Townsend. American Technical Society, Chicago, 1936. 436 pp. Price, $2.

This book is a practical treatise on simple building construction, including framing, roof construction, general carpentry work, exterior and interior finish of buildings, building forms, and working drawings.

The book is adapted for use as a text in vocational, trade, high, and technical schools. It is an excellent text for home

study and reference for carpenters, apprentices, home owners, and anyone interested in building construction work.—R. M.

Air Conditioning and Engineering. By Engineering Staff of American Blower Corporation and Canadian Sirocco Co., Ltd. American Blower Corporation, Detroit, 1935. 691 pp. Price, $5.

This is a treatise on the technic of conditioning and mechanical movement of air for the health and comfort of human beings and the efficiency of production in industry. It is a ready reference containing valuable data on air conditioning and engineering, including fundamental principles, laws, tables, sample calculations, and information relating to dimensions and capacities. In the apparatus and equipment section are found dimension and capacity tables and types of equipment used in actual practice. It is an excellent book for air-conditioning engineers.

—R. M.

A Guide to Sexing Chicks. By Charles S. Gibbs. Orange Judd Publishing Co., Inc., New York, 1935. 63 pp. Price, $1.25.

The author is a research professor of veterinary science at the Massachusetts State College at Amherst. In his Guide to Sexing Chicks he describes the art which was first brought to light by Kiyoshi Masui and Juro Hashimoto of Tokyo Imperial University, and later put into practical application by Kojima and Sakagiyma. He mentions two schools of chick sexing, one depending upon the presence or absence of processes in the vent, and the other on the wrinkles of the mucuous membrane of the cloaca.

Sexing chicks, as an art, requires skill, clear vision, rapid eye accommodation and ability to withstand bright light, steady hands, and nimble fingers. To the novice patient practice and mastery of its technic are necessary to attain a satisfactory degree of proficiency. The detailed description of the steps to be undertaken given in this book will be of practical value to him and other beginners.

The author suggests that sexing be done in bright day light or with the use of a 200-watt electric bulb, either blue or with frosted tip. The best time to sex is twelve hours after hatching or as soon as the chick has dried. A large process in the vent identifies a cockerel, and no process or a small one, a female. In actual identification a group of 5 per cent is confusing and may turn out one way or the other.—C. X. B.

The Medical Cookery Book. By Dorothy Sewart. J. Wright and Sons, Ltd., London, 1935. 136 pp. Price, $1.25.

In the convalescent stage of many diseases in which drugs usually play an insignificant part, nourishment is more vitally important to the patient, since a suitable diet is more conducive to recovery. At this stage the consideration of proper foods becomes the concern of those whose responsibility it is to prescribe diet. The 300 recipes compiled in this book for making soup, salads, and other ideal foods for convalescents will provide the solutions to most of the problems concerning the right foods to give. The recipes have been thoroughly tested and are simple and economical. The book also contains much information on how the foods should be served, which suggestions increase its practical value.—A. J. H.

International Trade; Principles and Practices. By Paul V. Horn. Prentice-Hall, Inc., New York, 1935. 723 pp. Price, $5.

A comprehensive treatise on its subject, this book not only deals with the principles and practices of foreign trade, but also treats of its historical background and its legal aspects. Intended primarily as a textbook for use in colleges and universities, the book will be found useful by students and by those who are actually engaged in international trade. A lot of valuable information is given which the latter, especially, could use to advantage to broaden their knowledge of the aspects of oversea trade as a profession. The subject is discussed as a business calling, and also as an instrument of governments in their international relations with one another.

Chapters 5 and 6 deal with a graphical survey of international trade. Chapters 10 and 11 give a history of tariffs in general and of United States tariff in particular, and trace the evolution of international commercial policies from antiquity to the present. Thoroughly discussed in Chapters 17 and 18 are the subjects of foreign investments, foreign exchange, and the financing of foreign trade. The practical modus operandi of foreign business trade is likewise fully treated, just as the technic of foreign-trade promotion and advertising and the collection of foreign credits are ably presented.

Adding much to the usefulness of the book are the review questions, problems, and suggested references at the end of each chapter.

A typographical error in the chart on page 154 (Organization of the United States Customs) is evident, the territories under

the jurisdiction of the Secretaries of War and Navy having been interchanged.—A. de C.

Lancashire Sea-Fisheries Laboratory. James Johnstone Memorial Volume. University Press of Liverpool, 1934. 348 pp. Price, 21s.

The latest tendency in the cultured world in the way of honoring a scholar is the publication of a memorial volume giving evidences of the world's appreciation of his work. For this purpose the present volume was prepared to commemorate the death of James Johnstone and his retirement from the chair of Oceanography at Liverpool in 1935. It is a symposium on various matters dealing with the sea, including its physical and biological phenomena. It includes original investigations on varied oceanographic topics, written by men identified with various well-known schools of thought, both of Europe and America. The articles are independent from one another, and the only coördination among them is that they reflect the world to which Johnstone dedicated himself. In each article much useful information will be found by the oceanographer, the embryologist, the geologist, the ecologist, the parasitologist, and the physical chemist.—H. A. R.

Researches on Vitamins, 1900–1911. By Prof. Dr. G. Grijns. J. Noorduyn en Zoon N. V., Gorinchem, 1935. 254 pp.

This book was prepared to give evidence of the admiration and gratitude which the world owes Dr. G. Grijns for his valuable contributions to the science of vitamins. It is a compilation of his early works covering his investigations on polyneuritis gallinarum, with which is included his thesis on "the physiology of the nervous opticus," translated into German, and which was published while he was still a student at the University of Utrecht.

Doctor Grijns is largely to be remembered for his classical researches on beriberi. With his predecessor Erijkman, a fellow Dutchman, he is acknowledged as one of the founders of vitamin science. Considering the consequences of his investigation and the benefits which mankind reaped from them, Grijns deserves more of the world's gratitude than can be expressed by the preparation of this memorial volume.

The book, however, is more than a commemorative volume. In making the classical studies of the author accessible in English translation, the book commends itself to a large circle of readers, especially those who are making a historical study of vitamin science.—A. J. H.